

# BANISTERIA

A JOURNAL DEVOTED TO THE NATURAL HISTORY OF VIRGINIA



Owlfly (*Ascaloptynx appendiculata*)

Owlflies are rarely seen members of the primitive insect order Neuroptera. The first summary of the Virginia representatives of this group and the closely related order Megaloptera appears on pages 3-47 of this issue.

# BANISTERIA

A JOURNAL DEVOTED TO THE NATURAL HISTORY OF VIRGINIA

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*Cover:* Owlfly (*Ascaloptynx appendiculata*); photographed in Pocahontas State Park (Chesterfield County) by Paul Bedell.

*Back cover:* Top: Mantisfly (*Zeugomantispa minuta*); photographed in Chesterfield County by Paul Bedell.

Bottom: Bog Twayblade (*Liparis loeselii*); photograph courtesy of Fort A.P. Hill, Environmental & Natural Resources Division.

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Number 45, 2015

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## Annotated Checklist of the Neuropterida of Virginia (Arthropoda: Insecta)

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### ABSTRACT

The superorder Neuropterida is represented in Virginia by the orders Neuroptera (lacewings, dustywings, antlions, owlflies, mantisflies, and allies) and Megaloptera (dobsonflies, fishflies, and alderflies). The counties and/or cities in the state from which each species is known are listed, with full data provided when there are very few collections. Detailed range maps are provided for most species and the Virginia flight season of each species is reported. In the Neuroptera, nine families, 35 genera, and 71 species are recorded from Virginia. Of these, 18 species appear to be new state records: *Ululodes macleayana*, *Chrysoperla downesi*, *Kymachrysa intacta*, *Leucochrysa (Nodita) callota*, *Helicoconis walshi*, *Hemerobius pacificus* (accidental), *H. pinidumus*, *H. simulans*, *H. stigmaterus*, *Megalomus angulatus*, *Climaciella brunnea*, *Dichromantispa sayi*, *Leptomantispa pulchella*, *Brachynemurus nebulosus*, *B. signatus*, *Chaetoleon pumilis*, *Glenurus gratus*, and *Sisyra apicalis*. In the Megaloptera, two families, six genera, and 18 species are listed. Two of these species are new state records: *Neohermes matheri* and *Protosialis glabella*. Some of these new records represent significant range extensions.

**Key words:** Neuroptera, Megaloptera, distribution, Virginia, new state records.

### INTRODUCTION

The superorder Neuropterida is comprised of three orders, Neuroptera, Megaloptera, and Raphidioptera, and contains, worldwide, around 6,500 described, recent species (Aspöck & Aspöck, 2003). The Raphidioptera, or snakeflies, are primarily a Northern Hemisphere group, in the New World being limited to west of the 100<sup>th</sup> Meridian, and south to the Mexican-Guatemalan border: as they do not occur in the eastern half of North America they are not further considered here. The other two orders, the Neuroptera (lacewings, dustywings, antlions, owlflies, mantisflies, and allies) and Megaloptera (dobsonflies, fishflies, and alderflies) are found in Virginia. The adults of all the Neuroptera are aerial and most of their larvae are terrestrial, the Sisyridae with their freshwater, sponge-feeding larvae being the exception. The adult Megaloptera are also aerial, but all their larvae are aquatic, feeding on other benthic creatures.

Herein are recorded 71 species of Neuroptera out of the approximately 335 species known from North America, i.e., north of the Mexican-USA border (Table 1). This amounts to 21% of the known North American

fauna. In the Megaloptera, 18 species out of 43 North American species are now recorded from Virginia. This is almost 42% of the fauna. There is still a considerable potential for the discovery of a few more species, known from nearby states, in Virginia.

### MATERIAL AND METHODS

The material reported on in this paper is deposited in a number of museums and collections: GWMP, George Washington Memorial Parkway, National Capital Parks-East, McLean VA, Mr. Brent W. Steury; INHS, Illinois Natural History Survey, records provided by Dr. S. M. Roble; MCZ, Museum of Comparative Zoology, Harvard University, Cambridge, MA, Dr. Philip D. Perkins; NMNH, National Museum of Natural History, Washington, DC; VMNH, Virginia Museum of Natural History, Martinsville, VA, Dr. Richard L. Hoffman; VPISU, Virginia Polytechnic Institute and State University, Blacksburg, VA, Mr. Eric R. Day, Dr. J. Reese Voshell, Jr., Mr. Stephen R. Hiner. Dr. Charles R. Parker provided a list of neuropteroid specimens in the collection of the Blue Ridge Parkway. In addition, Dr. Steven M. Roble and co-workers, Virginia

Table 1. Summary of the Neuroptera and Megaloptera fauna of Virginia (this study) as compared to the North American fauna (north of Mexico; data from Penny et al., 1997).

Order/Family	Virginia Genera	Species	N. America Species
<b>NEUROPTERA</b>			
Ascalaphidae	2	3	8
Berothidae	1	2	10
Chrysopidae	7	18	81
Coniopterygidae	5	9	55
Dilaridae	1	1	2
Hemerobiidae	6	19	61
Ithonidae	0	0	1
Mantispidae	4	5	15
Myrmeleontidae	7	11	94
Polystoechotidae	0	0	2
Sisyridae	2	3	6
Total	35	71	335
<b>MEGALOPTERA</b>			
Corydalidae	4	7	19
Sialidae	2	11	24
Total	6	18	43

Department of Conservation and Recreation, Division of Natural Heritage, have been most valuable, not only in collecting in many critical areas much of the material here reported but also in searching for material in other collections and guiding the author to many interesting sites: this material is deposited in the collections at NMNH and VMNH.

Identifications were made through use of relevant keys and papers and comparison with identified material, and often required clearing of the terminalia for a final verification. The usual method of warm KOH was used and the cleared terminalia are stored in a microvial pinned below the specimen or placed in the vial with the remaining specimen in the case of fluid preservation. For most work a Wild MC3 stereoscopic microscope was used, supplemented on occasion by a Leitz stereomicroscope when higher magnification and clarity of image was required.

Penny et al. (1997) was used as a guide to previous citations of the Neuropterida from Virginia. If the state was not cited therein, or in other references known to the author, the species of concern is considered a new state record. The marks \*\*\* following the species name indicate that the species is a new state record. Hagen's (1861) reference to *Ceraeochrysa cubana* from Virginia is discounted as discussed under *Ceraeochrysa*.

The author has all the records as a Word document (WP5.1), and is willing to provide a print-out of portions upon request. This document contains the label data, sometimes enhanced when necessary, including the numbers and sexes in the lot and its depository. I have condensed these numerous records down to a simple listing of the counties and cities from which I have seen each species. When there are few records for a species, usually three or less, I have given the full data. If a portion of the data is enclosed in brackets [ ], it means that the enclosed portion was not on the label but has been inserted by me. The dot maps have been constructed from the detailed data. In many cases, however, a species is known from numerous contingent collections or dates, and all are represented by a single dot. In a few instances the species is only known from a simple county record: these counties are represented by an X placed near the center of the county. In those cases where full data are given for an uncommon species, no dot map has been prepared.

## ORDER NEUROPTERA

### Family Ascalaphidae

The Ascalaphids, or owlflies, are a rather small neuropteroid family consisting of 12 genera in the New World (Penny, 1981). They are most diverse in the tropical regions, although a few species penetrate the temperate zones. North of the Mexican border only three genera and eight species are known. However the discrimination of many species, especially in the genus *Ululodes*, is most unclear because the genitalia do not offer obvious differences and coloration seems rather variable. The genus *Ascalobyas* is recorded only from Texas within the United States, and not treated further here, but the other two genera are known from VA.

### Genus *Ascaloptynx* Banks

This is a monospecific genus that is limited to the United States.

#### *Ascaloptynx appendiculatus* (Fabricius)

Fig. 1 and front cover photo

This species is comprised of three forms, recently synonymized (Penny et al., 1997), that are distributed from FL to AZ, north to MO and TN in mid-continent and VA along the East coast. Our records apply to the typical form. It has been collected several times in the Coastal Plain and lower Piedmont of southeastern VA in June and July.

Amherst, Appomattox, Chesterfield, Essex, Halifax,



Louisa, Nottoway, Sussex Co's., Virginia Beach City.

#### Genus *Ululodes* Currie

The genus contains some two dozen nominate species, some easily recognizable, but many rather cryptic. Unfortunately, the genitalia do not offer obvious distinguishing characteristics and wing color patterns seem quite variable. Six species are recorded from the USA, but with the exception of *U. quadripunctatus*, their differentiation is difficult.

*Ululodes macleayana* (Guilding) \*\*\*

In addition to the United States the species is known from the West Indies (St. Vincent is the type locality). In the USA it is recorded from FL to TX, north to MO and NJ, but not previously from VA. The Virginia record is based on a single female.

[Virginia Beach City], Oceana N[aval] A[ir] S[tation], 29 Jun 1976, W.A. Allen, BLT, 1♀ (VPISU).

*Ululodes quadripunctatus* (Burmeister) Fig. 2

This, the most common ascalaphid in Virginia, is sexually dimorphic, leading to the male, for many years, being classified as *Colobopterus excisus* Hagen. It ranges from FL to AZ, north to MI and ON. In Virginia it is widespread east of the Blue Ridge and has been taken from June to early September.

Alleghany, Amherst, Arlington, Bedford, Chesterfield, Dinwiddie, Essex, Fairfax, Franklin, Greene, Hanover, Henrico, Isle of Wight, Mecklenburg, Montgomery, Nelson, New Kent, Nottoway, Prince Edward, Prince George, Prince William, Richmond, Westmoreland, York Co's., Chesapeake, Lynchburg, Virginia Beach Cities.

#### Family Berothidae

This is another relatively small family of some 27 genera and around 100 species. They are most diverse in the Old World, especially Africa, Asia, and Australia. In the New World three genera with about five species are found south of the USA, but only one genus is known from the USA and Cuba.

#### Genus *Lomamyia* Banks

This, the sole genus found north of the Mexican border, contains 10 species described from the USA and one from Cuba. The larvae are found in termite nests where they prey on the inhabitants (Brushwein, 1987). The American species were revised by Carpenter

(1940). In addition to the two species recorded here, *L. longicornis* (Walker) is recorded from adjacent NC and may well be found in southeastern VA.

*Lomamyia banksi* Carpenter Fig. 3

Both this and the following species are relatively common and are attracted to lights and are frequently taken in Malaise traps. The species is recorded from FL west to LA and KS, and north to IL and NY. It has been taken widely in the state, but only sporadically west of the Blue Ridge. The records range from late May to early October.

Botetourt, Caroline, Chesterfield, Dickenson, Essex, Fairfax, Fauquier, Franklin, Greensville, Isle of Wight, Middlesex, Prince William, Shenandoah, Wise Co's., Richmond, Suffolk, Virginia Beach Cities.

*Lomamyia flavicornis* (Walker) Fig. 4

This is another species widely distributed in the southeast – FL to KS and north to NY. The late E. MacLeod once reported to me (pers. comm.) that there is a cryptic species involved in *L. flavicornis* that is only recognizable in the male genitalia and that it was also known from VA. In its current sense it is known primarily from the Coastal Plain and Piedmont areas in late May to late October.

Accomack, Arlington, Bedford, Chesterfield, Clarke, Essex, Fairfax, Fauquier, Isle of Wight, King William, Loudoun, Montgomery, Northampton, Nottoway, Prince William Co's., Suffolk, Virginia Beach Cities.

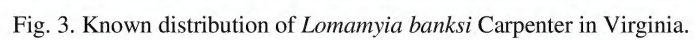
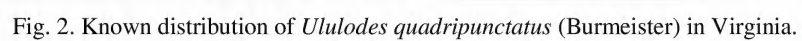
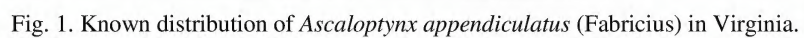
#### Family Chrysopidae

This is one of the largest families in the Neuroptera with over 1,200 species placed in around 90 genera. In spite of an excellent generic revision by Brooks & Barnard (1990), the generic classification and placement of species is still somewhat fluid and changeable. In the New World around 30 genera and 350 species are described, with 17 genera and 80 plus species recorded from north of Mexico. Although there is great diversity in the tropics, the family is well represented and diverse far into temperate climes, but only seven genera and 18 species are known from VA.

#### Genus *Ceraeochrysa* Adams

This is an exclusively New World genus containing 62 species (Freitas et al., 2009) found from Argentina north into Canada, including the West Indies. Six species are known from the USA (Tauber et al., 2000),





but a number more are recorded from Mexico or Cuba and may ultimately be taken in the USA. Most species are known only from FL or TX, only *C. lineaticornis* is more widespread, even reaching into southern Canada. In addition to the species authenticated below, there is an early record of *C. cubana* from VA (Hagen, 1861). Hagen listed it from the Allegheny Mountains, Virginia, but I believe that he actually had an example of *C. lineaticornis* which often appears much like *C. cubana*, a species which is currently verified only from FL in the USA. I, therefore, reject this record as a misidentification.

*Ceraeochrysa lineaticornis* (Fitch) Fig. 5

Although generally quite recognizable in its range, there is a good deal of variation in its appearance: the scape may be lacking its lateral stripe (syn. *C. columbiana*: recorded as such in Bickley & MacLeod [1956] from Mountain Lake [Giles Co.]) and the pronotum may have noticeable lateral stripes, either red or black (probable basis for the Hagen [1861] record of *C. cubana* in VA). Overall it is a widespread and fairly common species in eastern North America: FL west to TX and north to WI and QC, with a western record from BC. In Virginia it is widespread from the Coastal Plain through the Alleghenies. Its flight season is equally as long – May through October.

Accomack, Arlington, Bath, Clarke, Essex, Fairfax, Fauquier, Floyd, Giles, Grayson, Henrico, Highland, Isle of Wight, Lancaster, Louisa, Montgomery, Northampton, Patrick, Prince William, Russell, Sussex, Washington Co's., Chesapeake, Richmond, Suffolk, Virginia Beach Cities.

Genus *Chrysopa* Leach

This, the nomotypical genus in the family, once contained most of its described species. It has recently been split into many genera, but is still a diverse genus with nearly 50 species distributed mainly in the Palearctic and Nearctic Regions. In the New World it is almost exclusively found north of the Mexican border, but a few species also extend their ranges into Mexico. There are nine species recorded from north of Mexico, of which six are here recorded from VA.

*Chrysopa chi* Fitch Fig. 6

This is primarily a boreal species recorded in Canada from BC across the southern tier of provinces to NS and south to WA, MN, and TN. It has only rarely been collected in VA, and then mostly at higher elevations in the Blue Ridge and Alleghenies, with a

surprising low elevation record from Clarke Co. In addition to the localities listed below, Bickley & MacLeod (1956) recorded it from Mountain Lake (Giles Co.). I have seen numerous examples of *C. oculata* misidentified as *C. chi*, but believe all the below records are valid. The collection dates range from early June to late July.

Bedford, Clarke, Giles, Highland, Madison, Page Co's.

*Chrysopa incompleta* Banks Fig. 7

This would seem to be, in general, an Atlantic and Gulf Coastal Plain species, but it is more widely distributed than that. It is known from FL to TX, and north to WI and MA. In VA it is primarily known from the Coastal Plain and lower Piedmont, but with western sites in Dickenson, Patrick, and Lee counties. The collection dates range from May through October.

Accomack, Arlington, Chesterfield, Dickenson, Dinwiddie, Essex, Henrico, Isle of Wight, Lee, Northampton, Nottoway, Patrick, Southampton, Sussex Co's., Chesapeake, Petersburg, Richmond, Suffolk, Virginia Beach Cities.

*Chrysopa nigricornis* Burmeister Fig. 8

Its distribution in eastern North America ranges from NC west to TX and north to MN, ON, and QC and in the west from NM to CA north to BC and AB. In VA it is widely scattered across the state but with few records from the Coastal Plain or the lower Piedmont. Virginia collection dates extend from mid-May through late October.

Clarke, Dickenson, Fairfax, Frederick, Greenville, Highland, King George, Lee, Montgomery, Prince Edward, Prince William, Roanoke, Tazewell, Wise Co's., Charlottesville, Richmond, Virginia Beach Cities.

*Chrysopa oculata* Say Fig. 9

This is one of the most commonly collected neuropteroids in the state. In keeping with its wide distribution in the state, it has been taken from mid-Mexico north through almost every state and province, except the farthest north in Canada. It has been collected from early May to late October in VA.

Accomack, Amherst, Appomattox, Arlington, Augusta, Bath, Bedford, Botetourt, Buckingham, Campbell, Caroline, Chesterfield, Clarke, Dickenson, Dinwiddie, Fairfax, Fauquier, Floyd, Fluvanna, Franklin, Frederick, Grayson, Greenville, Halifax, Hanover, Henrico, Henry, Highland, Isle of Wight,



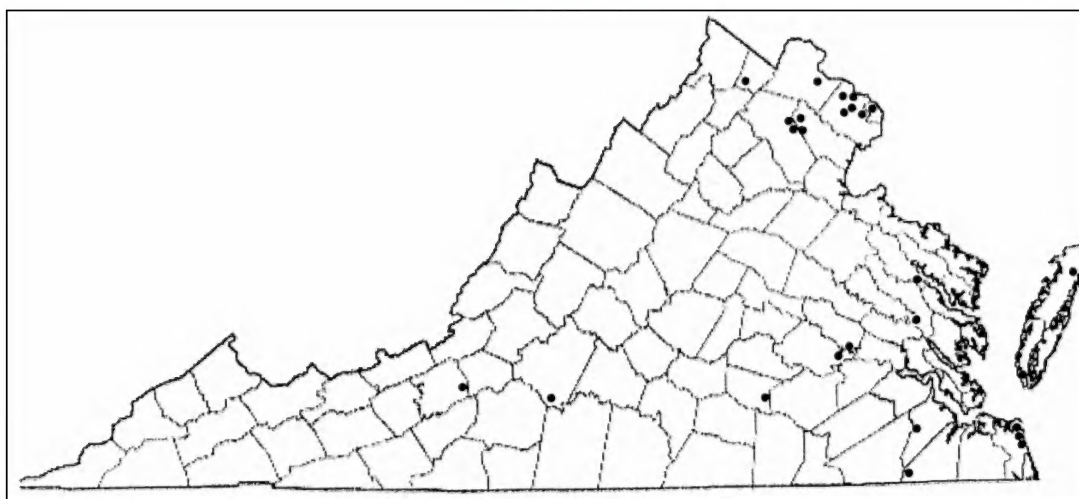


Fig. 4. Known distribution of *Lomamyia flavicornis* (Walker) in Virginia.

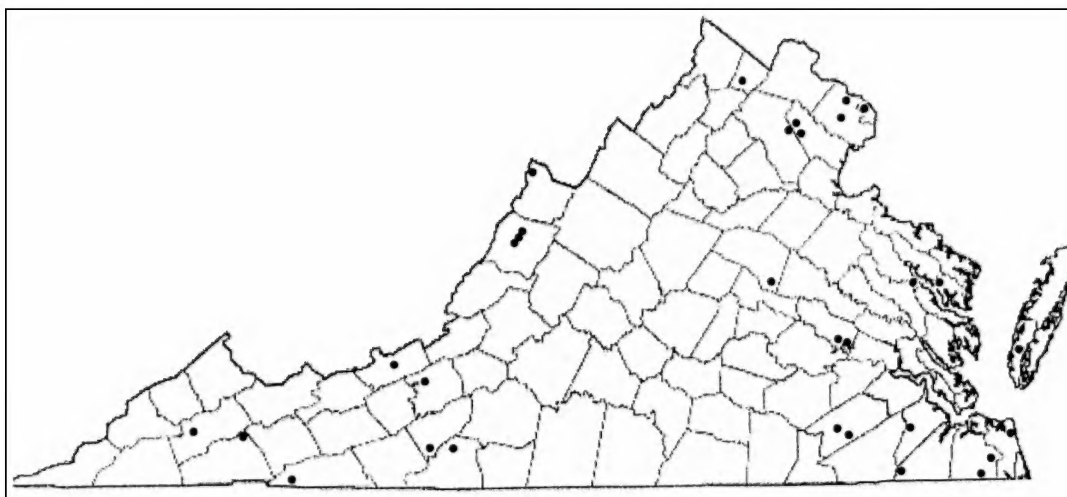


Fig. 5. Known distribution of *Ceraeochrysa lineaticornis* (Fitch) in Virginia.

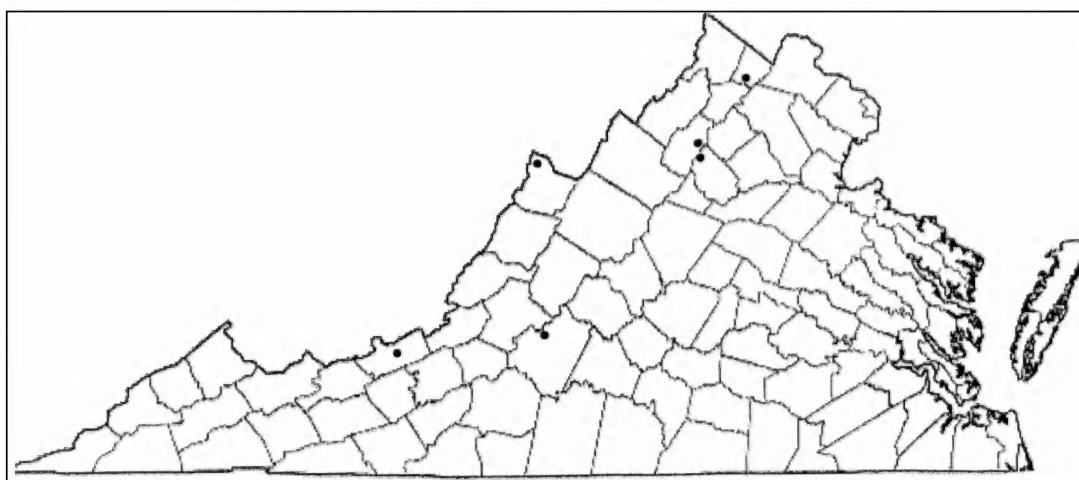


Fig. 6. Known distribution of *Chrysopa chi* Fitch in Virginia.



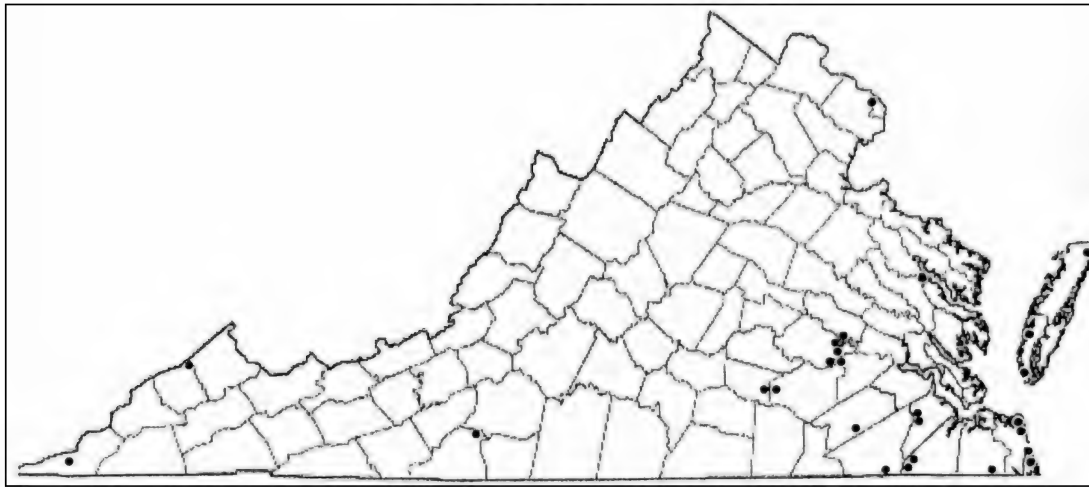


Fig. 7. Known distribution of *Chrysopa incompleta* Banks in Virginia.

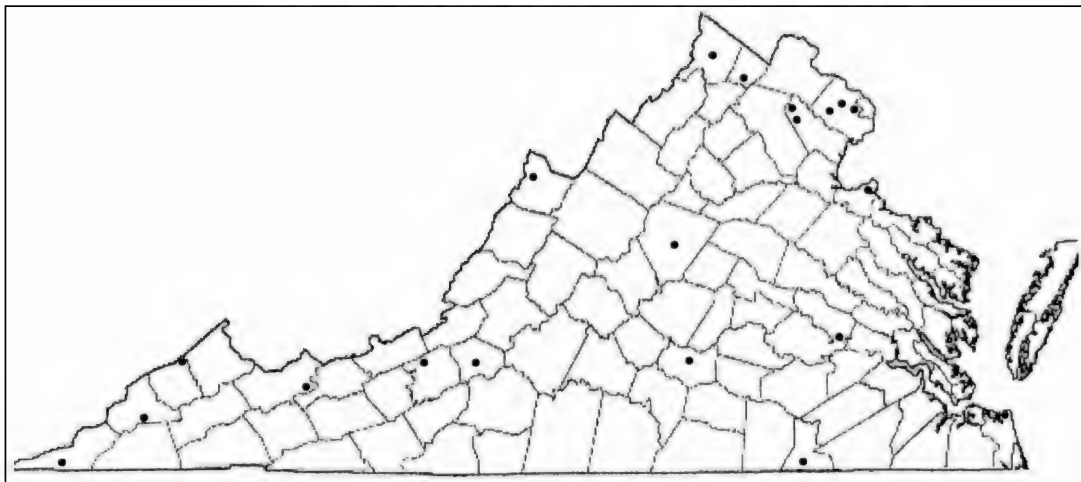


Fig. 8. Known distribution of *Chrysopa nigricornis* Burmeister in Virginia.

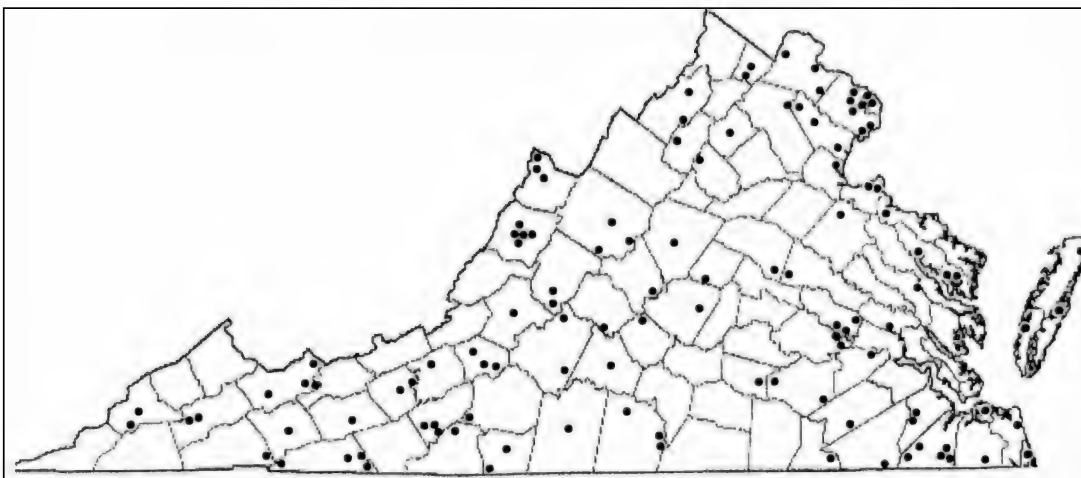


Fig. 9. Known distribution of *Chrysopa oculata* Say in Virginia.

King George, King & Queen/Middlesex, Lancaster, Loudoun, Louisa, Madison, Montgomery, Nelson, New Kent, Northampton, Nottoway, Page, Patrick, Pittsylvania, Prince George, Prince William, Pulaski, Rappahannock, Richmond, Roanoke, Rockbridge, Russell, Shenandoah, Smyth, Southampton, Stafford, Sussex, Tazewell, Washington, Westmoreland, Wise, Wythe Co's., Charlottesville, Chesapeake, Falls Church, Galax, Norfolk, Radford, Richmond, Roanoke, Salem, Staunton, Suffolk, Virginia Beach Cities.

*Chrysopa quadripunctata* Burmeister Fig. 10

The species has been found from SC west to TX and north to SK and PEI with western records from CA and BC. In VA, records are widely scattered across the state with collection dates of late April to mid-October.

Arlington, Bath, Bedford, Chesterfield, Clarke, Dickenson, Essex, Fairfax, Fauquier, Floyd, Goochland, Grayson, Greenville, Hanover, Henry, Highland, Isle of Wight, Madison, Montgomery, Nelson, Northampton, Page, Prince William, Warren, Wise Co's., Charlottesville, Chesapeake, Richmond, Virginia Beach Cities.

*Chrysopa slossonae* Banks

This relatively uncommon species has only been taken along the East coast from NC to NH. In VA it is known from a paratype taken at Great Falls (Fairfax Co.). It is a cryptic, sibling species closely related to *C. quadripunctata*. The larvae of *C. slossonae* are specialist predators on the woolly alder aphid (or alder blight aphid), *Prociphilus tessellatus* (Fitch), rather than generalist predators on arboreal aphids as in *C. quadripunctata* (Tauber et al., 1995).

A search for examples of *C. slossonae* using the key in Penny et al. (2000) was made through the *C. quadripunctata* material in the NMNH collection and some further examples were found. Two lots, one from Bar Harbor, ME and a series from Washington, DC that were reared from this aphid host are certain. Others from GA, MD, NC, VA, and WV seem fairly certain. Below are the data from the VA examples.

[Fairfax Co.] Belleview to Difficult Run, 3 Oct 1915, W.L. McAtee, 1♂, NMNH.

[Page Co.] Pass Run, Shenandoah Nat. Pk., 8 Jul 1961, O. & R. Flint, 1♂, NMNH.

Genus *Chrysoperla* Steinmann

Although the genus is distributed throughout the world there is a preponderance of its 36 described species in the Holarctic realm (Brooks, 1994). In the

New World, six species are limited to Mexico and southward, while another six are limited to north of the border, and an additional two are found in both regions. The genus is of especial economic interest because some species are being reared for pest control.

*Chrysoperla downesi* (Smith) \*\*\*

This is primarily a northern species seemingly restricted to coniferous trees (Tauber, 1974). In northeastern North America it is reported only from New England and NY, but in the West it is known from BC south to AZ throughout the mountains. The specimen recorded below shows all the characteristics of the species, though there are no definitive morphological criteria. This is the first record for VA and the southernmost record in the East. Its locality and ecological surroundings support the determination.

VA, Smyth Co., Whitetop Mtn., NW slope along App[alachian] Trail, red spruce, 1600m, N36.63907° W81.60897°, 30 August 2011, S.M. Roble, UV, 1♂, NMNH.

*Chrysoperla harrisii* (Fitch) Fig. 11

This species is distributed from NC west to TX and north to MT and ON with western records from CA and BC. Although not listed from VA in Penny et al. (1997), it was mentioned as occurring in the state, without specific locality, by Bram & Bickley (1963). Most of the VA records are from the Coastal Plain and lower Piedmont, but there are scattered records from as far west as the western border. VA capture records are primarily from May to October, but with a few records from mid-March and November that are consistent with the habit of adult hibernation in *Chrysoperla* (Tauber & Tauber, 1974).

Accomack, Amherst, Bath, Botetourt, Chesterfield, Dickenson, Dinwiddie, Fauquier, Franklin, Grayson, Halifax, Henry, Isle of Wight, Lancaster, Montgomery, Northampton, Nottoway, Patrick, Prince George, Prince William, Rockbridge, Southampton, Stafford, Westmoreland, Wythe Co's., Charlottesville, Suffolk, Virginia Beach Cities.

*Chrysoperla plorabunda* (Fitch) Fig. 12

The species is distributed all across North America from Mexico to Alaska (FL to CA and most of the Canadian provinces), but strangely enough, only once mentioned from VA (without specific locality, Bram & Bickley, 1963). Its relationship to the common Eurasian species, *C. carnea* (Stephens) is perplexing. The lack of distinguishing characters, including the male genitalia,

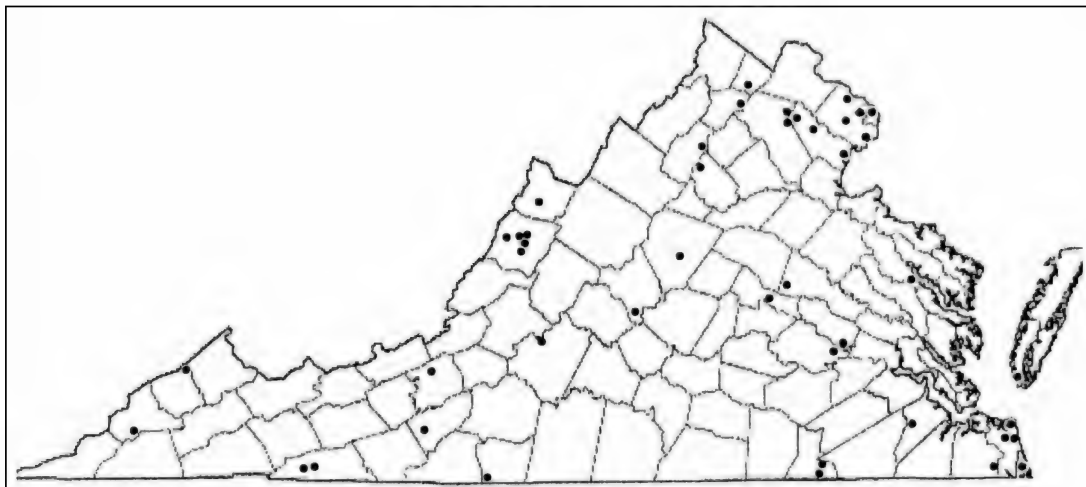


Fig. 10. Known distribution of *Chrysopa quadripunctata* Burmeister in Virginia.

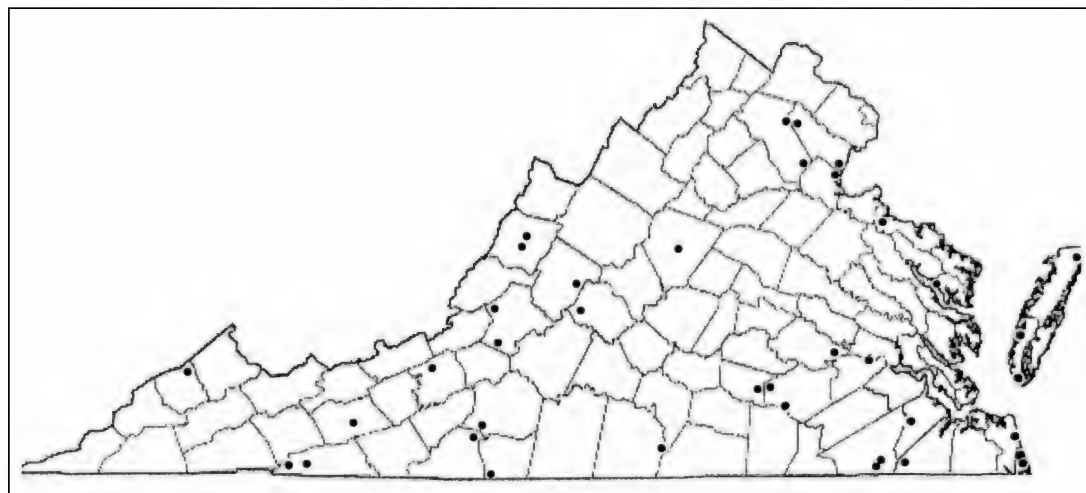


Fig. 11. Known distribution of *Chrysoperla harrisii* (Fitch) in Virginia.

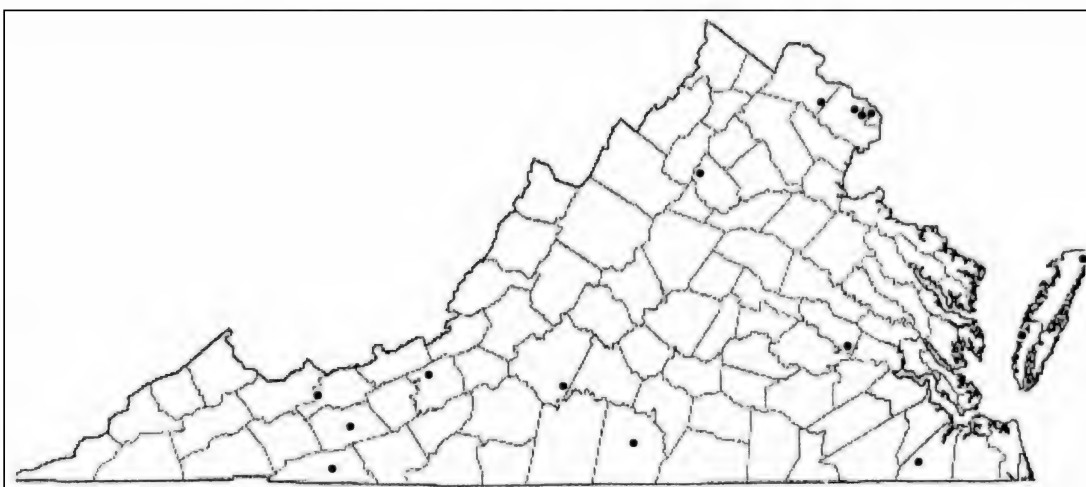


Fig. 12. Known distribution of *Chrysoperla plorabunda* (Fitch) in Virginia.



led to them being synonymized (Tjeder, 1960) for several decades. More recently, discovery of their “calling” systems has shown them to be very different and this has been supported by evidence of impaired ability to hybridize in laboratory situations (Henry, 1983). Therefore, the North American form is again recognized as a distinct species. Within VA, the species is widely distributed, although not frequently collected. Collection dates range from March to November, however, the species is known to overwinter as adults and to become active during warm spells in late winter (Sheldon & MacLeod, 1974).

Accomack, Arlington, Bedford, Fairfax, Grayson, Halifax, Loudoun, Madison, Montgomery, Northampton, Tazewell, Wythe Co's., Richmond, Suffolk Cities.

*Chrysoperla rufilabris* (Burmeister) Fig. 13

This and *C. oculata* are the two most common and frequently collected chrysopids in the state. The species was described from “mittel Amerika und Mexiko”, but is widely distributed across North America, though it appears to be lacking west of the 100<sup>th</sup> Meridian: FL to TX, north to MN and NS. It is widespread all across the state, from the Coastal Plain to the western border. It is frequently collected from March to late November with scattered records from December and February. The latter records are not surprising because the species overwinters as adults and may be active on warm winter days. The overwintering form is not green but generally a pale straw brown, which for a long time was believed to be a different species, *C. interrupta* (Schneider) (Bram & Bickley, 1963).

Accomack, Amherst, Arlington, Augusta, Bath, Bedford, Chesterfield, Clarke, Caroline, Dickenson, Dinwiddie, Essex, Fairfax, Fauquier, Floyd, Franklin, Frederick, Grayson, Greensville, Halifax, Hanover, Henrico, Henry, Highland, Isle of Wight, James City, King & Queen/Middlesex, Lancaster, Louisa, Madison, Montgomery, Northampton, Nottoway, Patrick, Prince William, Richmond, Roanoke, Rockingham, Shenandoah, Sussex, Tazewell, Westmoreland, Wise, Wythe, York Co's., Alexandria, Charlottesville, Hampton, Lynchburg, Newport News, Norfolk, Richmond, Suffolk, Virginia Beach Cities.

Genus *Eremochrysa* Banks

This is a fairly small genus limited to the New World. There are 14 described species: two known from Cuba, and the rest from the USA and Canada. They are most frequently encountered in desertic

regions in the western USA.

*Eremochrysa canadensis* (Banks) Fig. 14

This is a rarely collected species with a basic boreal distribution: New England and eastern Canada west to WI and BC. It has only recently been recorded from VA and WV (Roble & Flint, 2001). Within the state it is now recorded from seven collections in six counties. All the sites seem to be along ridge tops or high elevations. The collections have been made from late May to early September.

Bath, Bedford, Botetourt, Dickenson, Fauquier, Rockbridge Co's.

Genus *Kymachrysa* Tauber & Garland

This recently described genus was erected for two species that were previously placed, provisionally, in *Ceraeochrysa* (Tauber & Garland, 2014). One species, *K. placita* is known only from CO and, the other, *K. intacta*, is more widespread over Mexico and the USA.

*Kymachrysa intacta* (Navas) \*\*\* Fig. 15

This is the species long called *Chrysopa* (or more recently *?Ceraeochrysa*) *placita* in eastern North America. Only recently has it been distinguished from the true *K. placita*, limited to the western USA (Tauber & Flint, 2010). In western North America it is known from Mexico City north to CA and CO, and in the East from NC north to ON and QC. Within VA it is limited to higher elevations in the Blue Ridge and Alleghenies to the west. Collection dates in VA range from late May to late October.

Amherst, Bath, Bedford, Floyd, Franklin, Giles, Grayson, Highland, Rockbridge, Rockingham, Russell, Smyth, Wise Co's.

Genus *Leucochrysa*,

Subgenus (*Leucochrysa*) McLachlan

This is an exclusively New World genus and subgenus that is speciose in the tropical areas. Well over 40 species are placed in this subgenus, but because of variation in marking and form, the recognition of most is still almost impossible. Although most are continental, some are found in the West Indies and in eastern and southwestern USA. Two species occur in the US: the record of the third, *L. ampla* (Walker) from GA, seems to be based on a misidentification of *L. insularis* (Walker) (Tauber, 2004).

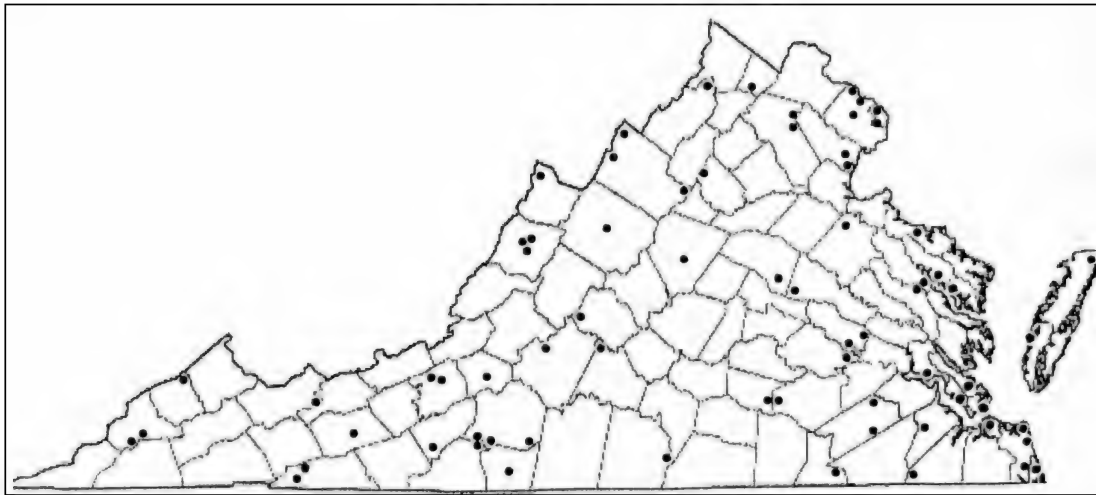


Fig. 13. Known distribution of *Chrysoperla rufilabris* (Burmeister) in Virginia.

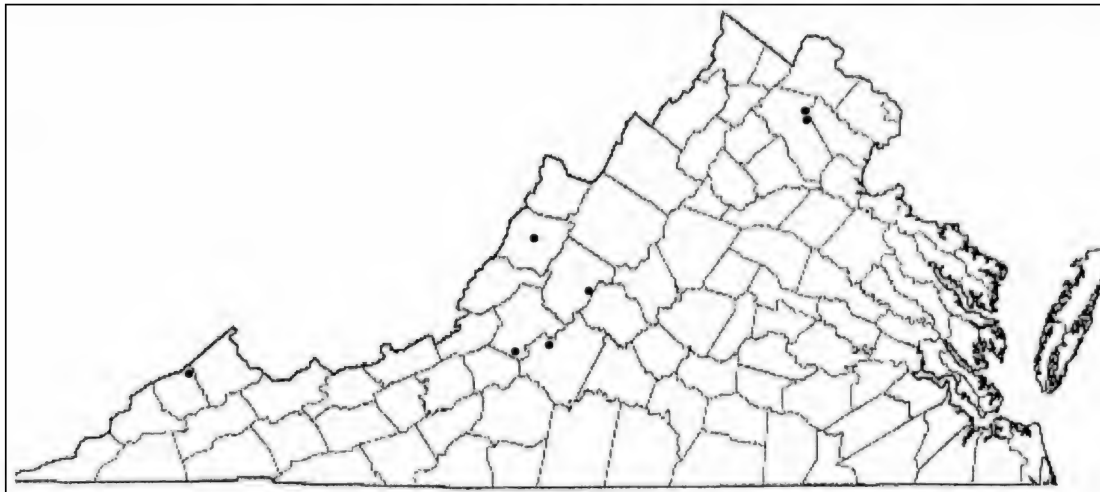


Fig. 14. Known distribution of *Eremochrysa canadensis* (Banks) in Virginia.

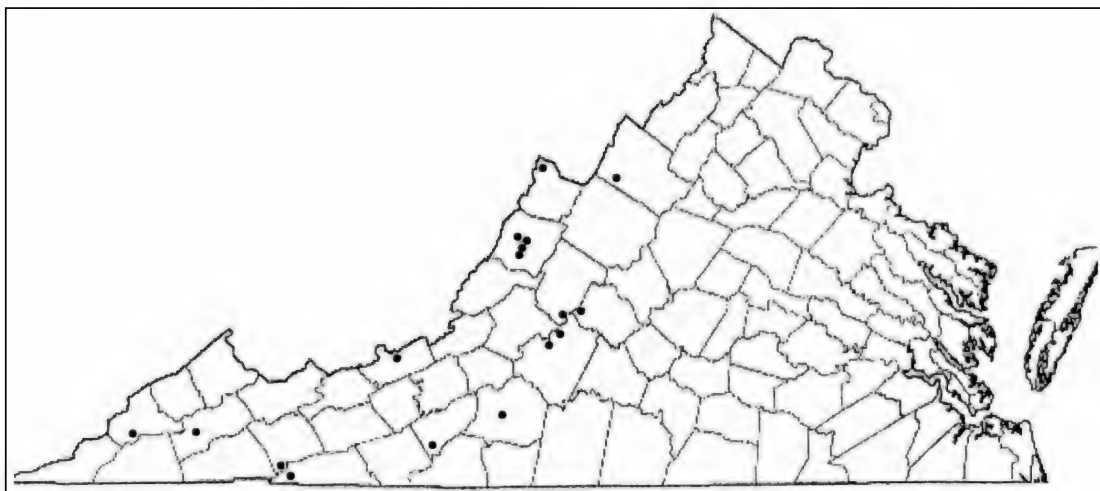


Fig. 15. Known distribution of *Kymachrysa intacta* (Navas) in Virginia.

*Leucochrysa (Leucochrysa) insularis* (Walker) Fig. 16

The type of the synonym *L. virginica* (Fitch) is from Cartersville [Cumberland Co.], VA. The type of *L. insularis* is from Jamaica and the species is known from the other Greater Antillean islands. In the USA, it is recorded from FL west to MS and north to IA and MA. It is commonly collected in Malaise traps over most of VA, but seems most common along the Coastal Plain and Piedmont. It has been collected from late May to late September.

Arlington, Chesterfield, Clarke, Culpeper, Cumberland, Dickenson, Essex, Fairfax, Fauquier, Greensville, Halifax, Hanover, Isle of Wight, Louisa, Montgomery, Prince Edward, Prince William, Sussex, Wise, Wythe Co's., Falls Church, Richmond, Suffolk, Virginia Beach Cities.

Genus *Leucochrysa*,  
Subgenus (*Nodita*) Navas

Compared with the subgenus *Leucochrysa*, *Nodita* contains by far the larger number of species with over 115 names. As with most tropical species, specific identification of many species is impossible; descriptions are vague and adults often express great variability in their appearance. The recent revision of *Leucochrysa* (Tauber, 2004) based on study of genitalia and larval stages has reduced this subgenus in the USA to five relatively easily identifiable species.

*Leucochrysa (Nodita) callota* (Banks) \*\*\*

This is primarily a Gulf coast species, having been known previously from FL to TX and north to SC, with a record from Yucatan, Mexico. The discovery of the species in VA was a surprise. Therefore I present the full data for the four collections, all of which are from the Coastal Plain, as could be expected from its known distribution.

Isle of Wight Co., 6km S Zuni at Blackwater River, 14-15 Jun 1989, W.E. Steiner, Malaise trap in burned-over pine & oak sandy scrub, 2♀, NMNH.

Isle of Wight Co., Blackwater Ecological Preserve, site 2, N36.82328°, W76.85229°, 3 Sep 2010, A. Evans & D. Loomis, 1♀, NMNH.

Northampton Co., Savage Neck Natural Area Preserve, high dunes site, 28 Jul 1999, Chazal & Foster, UV, 1♀, VMNH.

Sussex Co., Chub Sandhill N[atural] A[rea] P[reserve], N36.751350°, W77.489829°, 19 Jul-19 Aug 2011, A. Evans & D. Loomis, Malaise trap, 1♀, NMNH.

*Leucochrysa (Nodita) pavidata* (Hagen) Fig. 17

The species is relatively common in the southeastern USA with records from FL to TX and north to IL and VA, with additional records from Mexico. Although not listed from VA in Penny et al. (1997), Tauber (2004) lists it from the state and mentions two rearing records from First Landing State Park (Virginia Beach City) and the Great Dismal Swamp National Wildlife Refuge. The species has been collected throughout the Coastal Plain and Piedmont in VA with two records from Montgomery and Russell counties west of the Blue Ridge. The VA collections were made from mid-May to late September.

Accomack, Appomattox, Charles City, Chesterfield, Essex, Fairfax, Greensville, Halifax, Henry, Isle of Wight, King & Queen, Montgomery, Prince Edward, Prince William, Russell, Sussex Co's., Suffolk, Virginia Beach Cities.

Genus *Meleoma* Fitch

This exclusively New World genus was monographed by Tauber (1969). There are 26 described species, the majority of which are western, Central American, and northern South American. Two species are found in eastern North America, one of which is also found throughout the West.

*Meleoma emuncta* (Fitch) Fig. 18

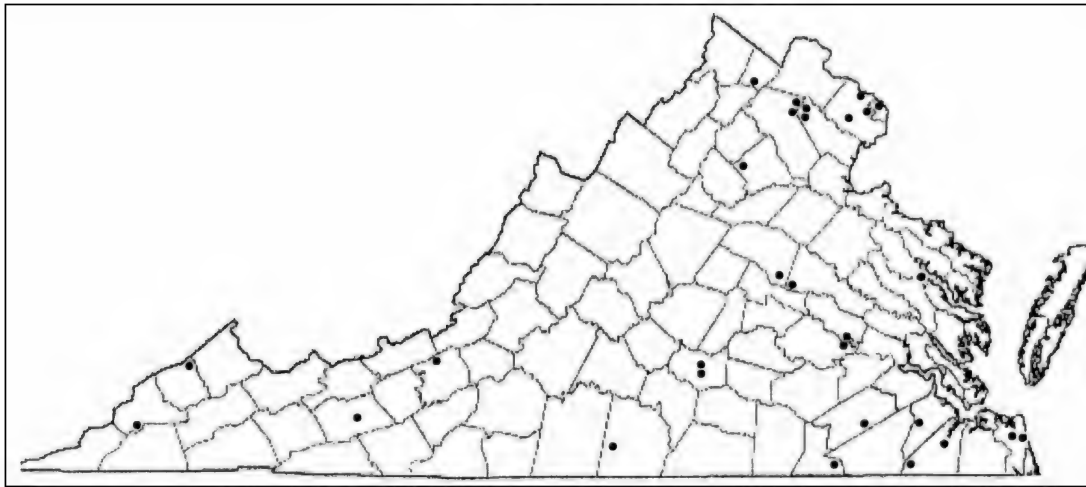
This species is found in both eastern and western North America. In the East it extends, primarily, down the mountains to NC and in the West south to NM and CA, and across the northern tier of states and provinces. In keeping with this pattern the VA records are along the Blue Ridge and Alleghenies, with a single outstanding record from Fort A.P. Hill in Caroline Co. The dates of collection range from late May to early September.

Bath, Bedford, Botetourt, Caroline, Giles, Grayson, Madison, Russell, Wythe Co's.

*Meleoma signoretii* (Fitch) Fig. 19

In distribution this species is much like the former in the East, being distributed south along the mountains to NC and TN, but it is not found in the western states, occurring only as far west as MN in the USA but to BC in Canada. All VA records are along the Blue Ridge and Alleghenies, but it is found in MD on Plummer's Island in the Potomac River (opposite Fairfax Co.). The VA collection records are from late May to early



[illegible]

A map of Virginia showing its county boundaries. Twelve sampling sites are marked with black dots. The sites are distributed across the state: two in the western part (Shenandoah County area), one in the north-central part (Stafford County area), one in the central part (Stafford County area), one in the south-central part (Stafford County area), one in the southwestern part (Stafford County area), one in the southwestern part (Stafford County area), one in the southwestern part (Stafford County area), one in the southwestern part (Stafford County area), one in the southwestern part (Stafford County area), one in the southwestern part (Stafford County area), one in the southwestern part (Stafford County area), and one in the southwestern part (Stafford County area).

Fig. 18. Known distribution of *Meleoma emuncta* (Fitch) in Virginia.

September. The species is often taken in company with *M. emuncta*.

Augusta, Bath, Bedford, Botetourt, Dickenson, Floyd, Giles, Grayson, Halifax, Highland, Roanoke, Russell, Washington, Wythe Co's.

#### Family Coniopterygidae

This family is known as the dusty- or mealywings because they are typically covered with a white, waxy secretion. All species are quite small, rarely having a wing length of more than 2-3 mm. Because of their small size and inconspicuous nature they are seldom collected except in Malaise traps and rarely at lights. Some two dozen genera and 423 species (Meinander, 1990) are described and they are found in all faunistic regions of the world. In the New World, 10 genera and over 135 species are known, of which eight genera and 55 species are recorded from the USA and Canada. Five genera and nine species are known from VA. The first modern monograph is by Meinander (1972), with a later update by Meinander (1990).

#### Genus *Aleuropteryx* Löw

The genus is primarily distributed throughout the Holarctic Region with a couple of species known from South Africa. The 14 North American species are found primarily in the arid Southwest, with one introduced species known from the Northeast.

#### *Aleuropteryx juniperi* Ohm

The species seems to be native to Europe where it is widespread as far east as Kazakhstan. It has only been reported from NY west to MI and south to VA in the New World. It would seem to be a recent introduction. It is a predator on scale insects of cultivated juniper and would appear to be spread through the nursery trade (Wheeler, 1981). In VA it is still known only from the original two collections made in Fairfax Co. (Flint, 1974).

Fairfax Co., George Mason Univ., 6 Jul 1973, R.W. Baumann, 1♂; same, but 15 Jul 1974, 27♂, NMNH.

#### Genus *Coniopteryx* Curtis

This is a very large genus of over 150 described species with a worldwide distribution. In the New World, more than 55 known species are distributed from Chile to Canada, including Hawaii and the West Indies.

#### *Coniopteryx simplicior* Meinander Fig. 20

This species is widespread throughout the southern USA as far north as AR, IN, and NY, but it is also recorded from Jamaica, Mexico, and south to Brazil and Bolivia. The few VA records are from the northeastern parts of the state with a record from a mountain top in Augusta Co. and another record from the southeastern pine barrens. The collection dates range from May through August.

Augusta, Essex, Fairfax, Fauquier, Prince William, Russell Co's., Falls Church, Suffolk Cities.

#### *Coniopteryx tineiformis* Curtis

This is another species described from, and widespread in, Europe and Asia Minor, but also across northern North America from Alaska to QC and south to CA in the West and TN in the East. The extensive North American distribution leads to the suspicion that it may be native, not an introduction. Meinander (1972) recorded it from Hawksbill, Shenandoah National Park (probably Madison Co.), 16 May 1962; I have only two more counties to add.

Bath Co., Warm Springs Mountain, Bald Knob, 4200ft., 15 Jun 1999, J.C. Ludwig, UV light in oak-pine woods, 2♂; same, but 1km N of airport, 2 Aug 1999, VDNH survey, oak-pine barren, 1♂, VMNH.

Fairfax Co., Turkey Run Park, riverside, 38° 57.9' N, 77° 09.4' W, 3-17 May 2007, D.R. Smith, Malaise trap, 1♂, GWMP.

#### *Coniopteryx westwoodi* (Fitch) Fig. 21

This species is limited to eastern North America, from FL to TX and north to MB and QC. The VA records are primarily from the northeastern part of the state with a few from the Alleghenies. The collection dates range from late April to late September.

Augusta, Bath, Clarke, Essex, Fairfax, Prince William Co's.

#### Genus *Conwentzia* Enderlein

This is a rather small genus of some 11 described species. They are found throughout Europe, Africa, southern Asia, and Indonesia in the Old World. Four species are known from Mexico and North America in the New World.

#### *Conwentzia pineticola* Enderlein

This is another widespread Eurasian species also

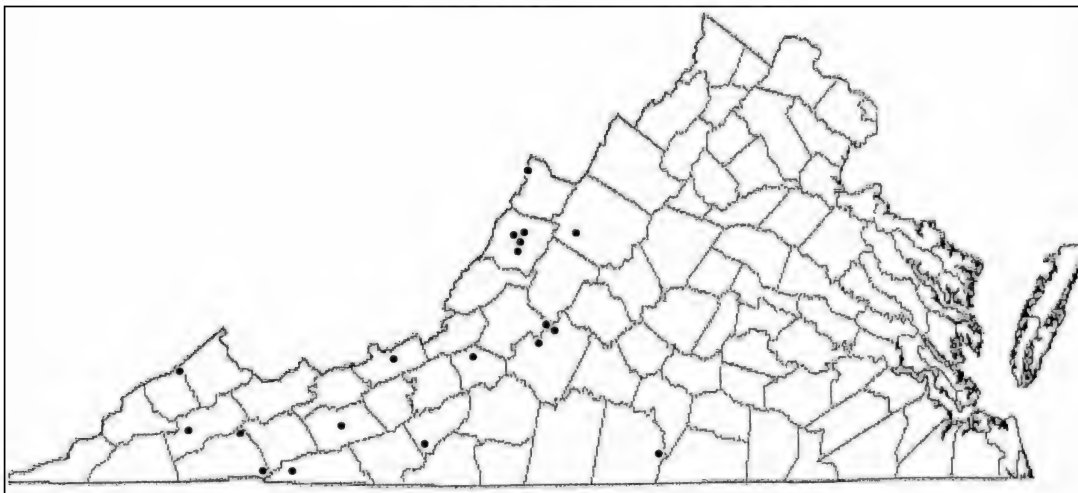


Fig. 19. Known distribution of *Meleoma signoretii* (Fitch) in Virginia.

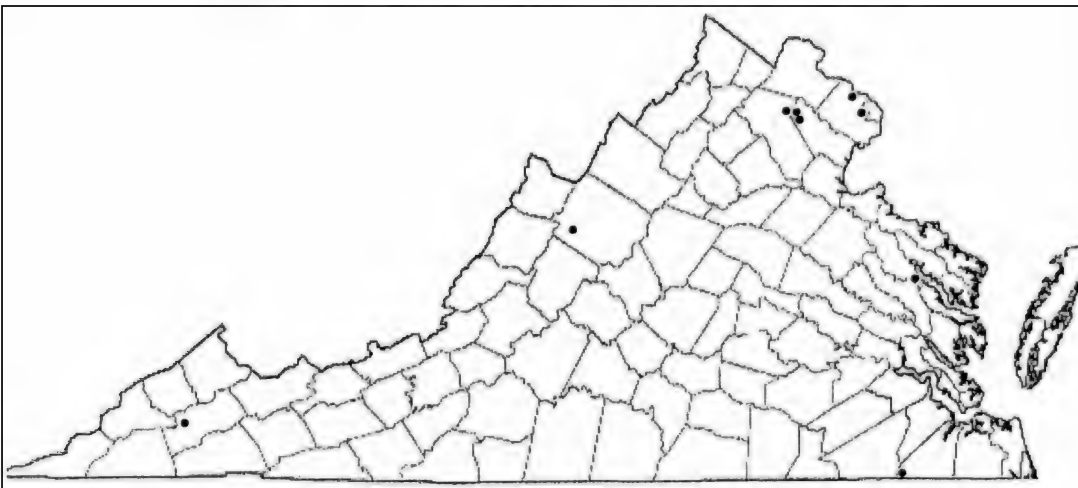


Fig. 20. Known distribution of *Coniopteryx simplicior* Meinander in Virginia.

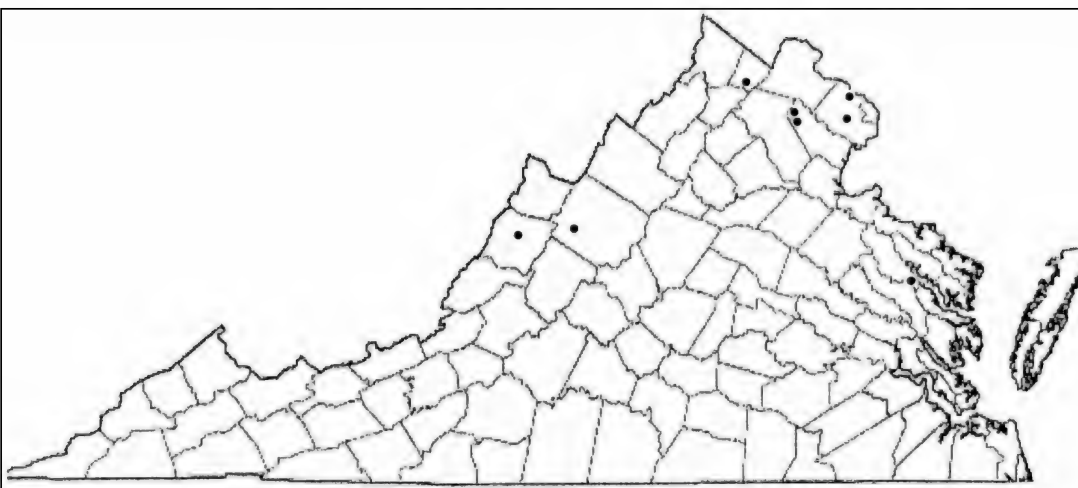


Fig. 21. Known distribution of *Coniopteryx westwoodi* (Fitch) in Virginia.

recorded from North Africa, Mongolia, and a possible record from Japan. It is an eastern species in North America, being recorded from FL to AR and north to BC and Newfoundland. The few VA records are from the northeastern part of the state with a single questionable record from the southern Blue Ridge.

[Arlington Co.] Glencarlyn, 9 Nov, N. Banks, lectotype, ♀, of its synonym *C. hageni*, MCZ.

[Fairfax Co.], Holmes Run Acres, 26 Apr 1961, W.W. Wirth, light trap, 1♂, 1♀, NMNH.

Fairfax Co., nr. Annandale, 38° 50' N, 77° 12' W, 21-27 May 1995, D.R. Smith, Malaise trap, 1♀, NMNH.

Washington Co., Apr 1991, E. Day, sticky trap, 1♀, VPISU.

#### *Conwentzia psociformis* (Curtis)

This species has a distribution much like the preceding, but it is also reported from New Zealand and more widely in eastern Asia. Its New World distribution is much more circumscribed, only being recorded from OH, NJ, and VA in the USA and from BC in Canada. Meinander (1975) recorded a specimen from Fairfax collected by Baumann in the NMNH: this specimen is now missing, but the published data are repeated below.

Fairfax Co., nr. Annandale, 38° 50' N, 77° 12' W, 11-27 Apr 1999, D.R. Smith, Malaise trap, 1♂, 1♀, NMNH.

Fairfax Co., Fairfax, 22 Jun 1974, R.W. Baumann, 1♂ (NMNH, now missing)

#### Genus *Helicoconis* Enderlein

The genus is known from the Holarctic Region and Africa. It contains about two dozen species, of which four are known from North America. One of these is here recorded from Virginia for the first time.

#### *Helicoconis walshi* (Banks) \*\*\*

This species is only recorded from five states, mostly in the northeastern United States, but there is a single record from CA. The eastern records are from IN, ME, MI, and WI. The nearest record is IN, but the precise locality was not mentioned. Starting from central IN, the VA record is approximately 300 miles (480 km) SE.

Grayson Co., Grayson Highlands St. Pk., Massie Gap, ca. 100m NE of parking area, 1 June 2011, S.M. Roble, UV, red spruce patch, 1♂, NMNH; same but Cox Visitor Center, Haw Orchard Mtn., 2 June 2011, S.M. Roble, UV, yellow birch-red spruce forest, 1♂,

NMNH.

#### Genus *Semidalis* Enderlein

This rather large genus is comprised of around 60 described species known from Europe and Africa with a few described Asian species. It is well represented in the New World with at least 35 species described from Chile north to southern Canada.

#### *Semidalis inconspicua* Meinander Fig. 22

This species has a fairly widespread distribution across the southern USA: CA and AZ to OK east to MD and VA then north to WI and IN. There is a problem with the type locality. The label reads "Falls Church, Va / Holmes Run / 6 vi 1961/ W.W.Wirth / light trap". Holmes Run is entirely within Fairfax Co., and I know that Dr. Wirth lived in Holmes Run Acres, a development at approximately 38° 51' N, 77° 12.5' W, quite close to Holmes Run. Although this site is in Annandale, Fairfax Co., its mailing address is Falls Church, and that is probably the reason for the "Falls Church" part of the label. Wirth previously lived nearer to Falls Church, but I have forgotten exactly where, though it still should have been in Fairfax Co., but with the same mailing address. The dates of collection extend from early June to late September.

Bath, Fairfax, Montgomery Co's. Falls Church City [but probably Annandale, Fairfax Co., N38°51' W77°12.5'], ♂ holotype, NMNH.

#### *Semidalis vicina* (Hagen) Fig. 23

Although the species is recorded rarely from Europe and North Africa, it seems to be most common in eastern North America. In the New World it is recorded from FL west to KS and north to MN and ME, with a doubtful record from central AB. It is quite common in VA, having been collected widely in the Coastal Plain and Piedmont, with a few records from the Blue Ridge and Alleghenies. Within VA it has been collected from late April to late September.

Arlington, Augusta, Clarke, Essex, Fairfax, Fauquier, Floyd, Grayson, Louisa, Nottoway, Prince William Co's., Falls Church City.

#### Family Dilaridae

This is a rather small family with species scattered across southern Europe, South Africa, and Asia as far as the island of Borneo, but not reaching New Guinea or Australia. The most recent catalogue (Oswald, 1998) recognized two subfamilies, four genera, and 67



species, although many of the species are not well known and may be synonymized with further study. All 17 New World species are placed in the genus *Nallachius* of the subfamily Nallachiinae; the genus also contains one species each from South Africa and Vietnam. Only two species are found in the USA, neither of which is known from Canada.

*Nallachius americanus* (McLachlan) Fig. 24

This species is widespread in the eastern USA: FL to TX and north to MI and MD. It is also recorded from Puerto Rico and south through Central America to Venezuela. The only other North American species, *N. pulchellus* (Banks) is known from AZ south to Costa Rica and Cuba. Although *N. americanus* comes to lights, it is most frequently collected in Malaise traps. Females are rarely collected by these methods, but are reared or found on host trees. The species is most frequently taken in the Coastal Plain and Piedmont regions of VA, with one record from west of the Blue Ridge. Most specimens have been collected from late May to late August with one reared specimen emerging in early April. Kuhar (1995) assembled the known VA records up to that date.

Amherst, Chesterfield, Clarke, Essex, Fairfax, Fauquier, Hanover, Montgomery, Prince William, Sussex Co's.

Family Hemerobiidae

The Hemerobiidae or brown lacewings are, for the Neuroptera, a large and diverse family containing 25 genera when it was last revised (Oswald, 1993): since then at least three more genera have been added. The species count was estimated at 600 in 2004 (Oswald, 2004), with representatives in all faunal realms. At least 15 genera and 240 species are known from the New World, of which 61 species placed in six genera are known from the USA and Canada.

Genus *Hemerobius* Linnaeus

This, the type genus of Hemerobiidae, contains the largest number of described species for any genus in the family, and is also one of the most widely distributed. At least 50 species are known from the New World (Monserrat, 1996), of which 14 are found north of Mexico. Our fauna has been revised a number of times, of which Carpenter's (1940) study still remains definitive. In addition, the genus from Canada and Alaska was covered in more detail by Klimaszewski & Kevan (1985) and Kevan &

Klimaszewski (1987). I here present records for seven species known from VA.

*Hemerobius conjunctus* Fitch

This species and *H. pinidimus* were synonymized by Carpenter (1940), however Klimaszewski & Kevan (1985) pointed out differences between the two, rightly elevating them to separate status again. The species is widespread all across Alaska and Canada and in the western USA south to NM and in the east to NC and TN. Although the species was reported from VA earlier (Roble & Flint, 2001), one of the three original collections was misidentified due to the above-mentioned synonymization. Both species have been taken in VA, but only rarely, and both from high elevations in the Blue Ridge and Alleghenies. It seems to be associated with coniferous forests.

Grayson Co., DF site off FS 89, Whitetop Mtn., 5000', 23 Jun 1993, VMNH survey, 1♀, VMNH.

Grayson Co., Grayson Highlands St. Pk., Massie Gap, ca. 100m NE of parking area, 1 June 2011, S.M. Roble, UV, red spruce patch, 2♂, NMNH; same but Cox Visitor Center, Haw Orchard Mtn., 2 June 2011, S.M. Roble, UV, yellow birch-red spruce forest, 2♀, NMNH.

Highland Co., Buck Run ponds [Locust Spring picnic area, George Washington National Forest, 38°35'N, 79°38'W; elevation ca. 1115 m (3657')], 6 September 1994, S.M. Roble, UV light, 1♀, VMNH; same but 4 September 2008, 1♀, NMNH.

Smyth Co., Jefferson Natl. Forest, Whitetop Mtn., 1600m, N36.63907°, W81.60897°, 11 July 2012, S.M. Roble, NW slope along App[alachian] Trail, red spruce, UV, 1♂, 1♀, NMNH.

Wise Co., cabin [36°53'N, 82°33'W, elevation 975 m (3200')] near Robinson Knob, 5 km SW Tacoma [= 1 km SW jct. county routes 699 and 706, Jefferson National Forest], 7-9 June 1993, S.M. Roble, UV light, 1♀, VMNH.

*Hemerobius costalis* Carpenter

This species is known in VA from the two collections listed in Roble & Flint (2001) and a new one reported here, all taken at high elevations in the Blue Ridge and Allegheny Mountains. Its distribution is widespread in northern North America: AK, all across Canada, south in the Rocky Mts. to CO, and in the East to VA.

Giles Co., Mountain Lake, Bald Knob, 1325m, 37°20'N, 80°32'W, 27 Jun 1992, W.E. Steiner, J.M. Swearingen, C. Davis, 1♀, NMNH.

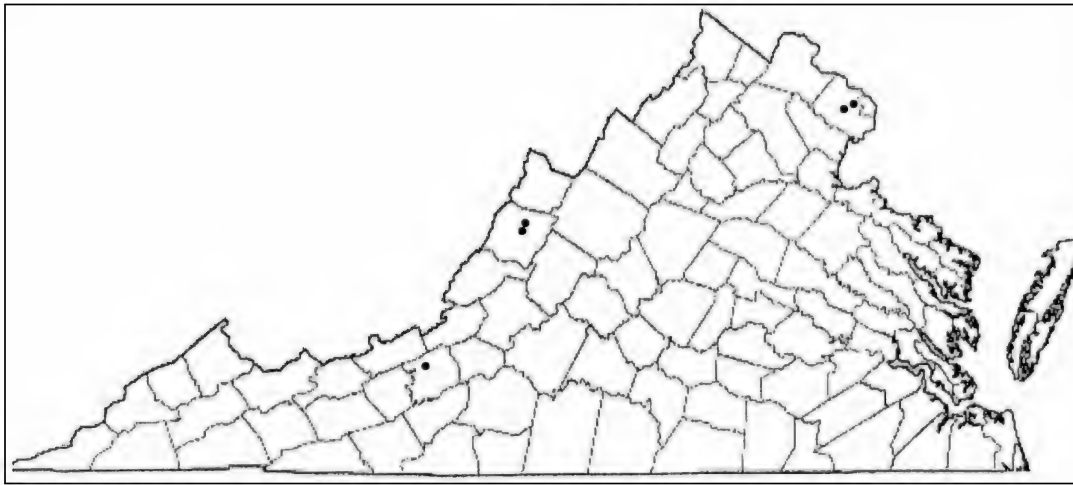


Fig. 22. Known distribution of *Semidalis inconspicua* Meinander in Virginia.

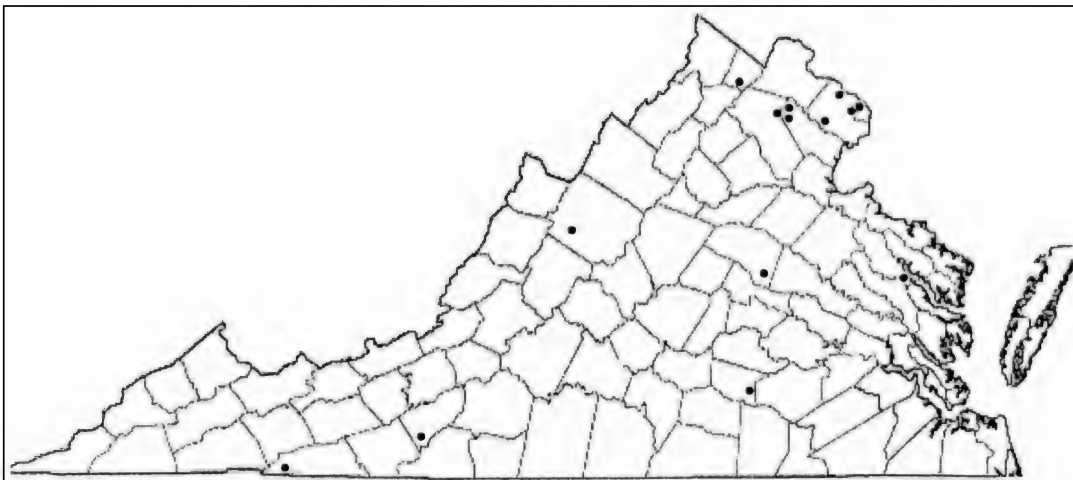


Fig. 23. Known distribution of *Semidalis vicina* (Hagen) in Virginia.

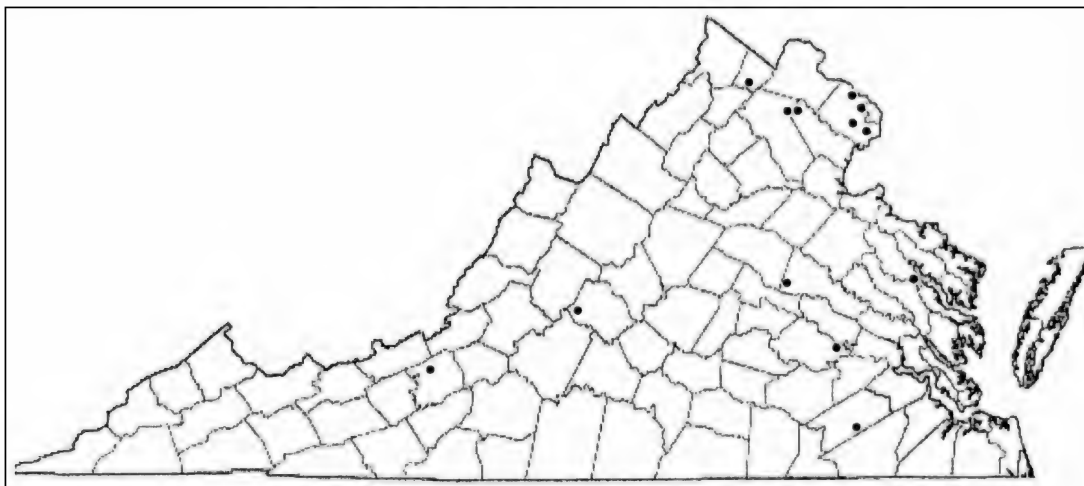


Fig. 24. Known distribution of *Nallachius americanus* McLachlan in Virginia.

Grayson Co., Grayson Highlands State Park, main park road ca. 200m N picnic road turnoff, 1 Sep 2011, S.M. Roble, UV, 1 lacking genitalia, NMNH.

Nelson Co., The Priest, drift fence at 3900ft., 7 Jul 1994, VMNH survey, 1♂, 2♀, VMNH.

*Hemerobius humulinus* Linnaeus Fig. 25

This appears to be a truly Holarctic species being known all across Europe, Asia (including far eastern Russia and Japan), Canada, and the USA. In the USA the species barely reaches the Rocky Mts., but otherwise is found east to the Atlantic Ocean. It is found all across VA, from late February to late November. It has been collected at ultraviolet lights, in Malaise traps, and by net.

Accomack, Albemarle, Arlington, Bath, Bedford, Chesterfield, Clarke, Dickenson, Dinwiddie, Essex, Fairfax, Fauquier, Frederick, Giles, Goochland, Grayson, Hanover, Highland, Isle of Wight, Louisa, Madison, Montgomery, Northampton, Prince William, Rockingham, Russell, Smyth, Stafford, Sussex, Wise Co's., Falls Church, Roanoke, Staunton, Virginia Beach Cities.

*Hemerobius pacificus* Banks \*\*\*

This is a western species with many records from TX to CA and north to AK and MB. Only one specimen has been found east of the Great Plains, and that in VA. This is a puzzling record, but its identity and collection data seem certain. Perhaps it pupated on a vehicle in the West, and was driven east to hatch near the point where it was taken in a Malaise trap.

Fairfax Co., nr. Annandale, [N38°50', W77°12'] 23-29 May 1993, D.R. Smith, Malaise trap, 1♂, NMNH.

*Hemerobius pinidumus* Fitch \*\*\*

Now that this species and *H. conjunctus* have been recognized and characterized, it is possible to correctly identify them. It transpires that both species are present in the state, although very rarely collected. This species is found widely across North America: AK and Canada, and then in the East from MN to ME and south to IN and VA; there is also a record from CO in the West. Two of the VA records are from the Allegheny Mtn. region, but the Clarke Co. record is from the northern Piedmont: none of them are at particularly high elevations.

Clarke Co., U. Va. Blandy Exp. Farm, 3mi S Boyce, 39°05'N, 78°10'W, 20 Apr-4 May 1995, D.R. Smith, Malaise trap, 1♂, NMNH (misidentified as *H.*

*conjunctus* in Roble & Flint, 2001).

Craig Co., Craig Crk, Va. 613, 2.5mi E Barbours Creek, 19 Sep 2000, A.C. Chazal & S.E. White, 1♂, VMNH.

Wise Co., Powell Mountain Karst Preserve, Cedar Ridge, ca. 1.3km E Cracker Neck Church, 36.85483°N, 82.69983°W, 22 Sep 2009, S.M. Roble & C.S. Hobson, UV trap 1, 1♂, NMNH.

*Hemerobius simulans* Walker \*\*\*

This is a circumpolar species known from all across Europe and Far Eastern Asia, Canada, and Greenland. In the USA, it is recorded from as far south as MA and NY in the East and CO and NV in the West. In NY, it is recorded from Lake Placid, a site about 580 miles (930 km) to the north of the Highland Co. record. The Grayson Co. record is almost another 180 miles (290 km) to the southwest.

Grayson Co., Grayson Highlands St. Pk., Massie Gap, ca. 100m NE of parking area, 1 June 2011, S.M. Roble, UV, red spruce patch, 1♀, NMNH.

Highland Co., Rifle Ridge Farm, at VA-WV border, S of Rt. 642, 15 June 2011, S.M. Roble, UV, N. hardwoods, 1♀, NMNH.

*Hemerobius stigmaterus* Fitch Fig. 26 \*\*\*

This species is generally referred to as *H. stigma* Stephens, a Eurasian species, in the literature. I have compared male genital structures in European and American examples and thought I detected some small differences; for this reason I still prefer the name proposed for the North American population. It may well be a truly Holarctic species, but it may turn out to be two sibling species. We need a careful DNA analysis of examples from Europe, eastern Asia, and eastern and western North America for a final resolution. It is the most widespread *Hemerobius* species in North America, being recorded from coast to coast from Alaska south to the Mexican border, but apparently not from Mexico. It is equally widespread in VA being known from all parts of the state, but, surprisingly, was not previously reported from here. The species may overwinter as a hibernating adult or as a pupa, and, consequently, can be found any time of the year at appropriate temperatures.

Accomack, Alleghany, Arlington, Augusta, Bath, Bedford, Botetourt, Campbell, Caroline, Chesterfield, Clarke, Craig, Dickenson, Dinwiddie, Essex, Fairfax, Fauquier, Frederick, Giles, Grayson, Halifax, Henrico, Highland, Isle of Wight, Louisa, Madison, Montgomery, Northampton, Prince William, Rockingham, Shenandoah, Southampton, Stafford,



Sussex, Westmoreland, Wise, Wythe Co's., Falls Church, Richmond, Suffolk, Virginia Beach, Winchester Cities.

#### Genus *Megalomus* Rambur

This genus contains at least 40 species (Oswald, 1993), of which about 30 are recorded from the New World (Monserrat, 1997). Species are lacking in the Afrotropical and Australian Regions and in reduced numbers in the Oriental, but otherwise widespread. Only seven species are known from north of the Mexican border, some of which are also widespread in Mexico and south.

#### *Megalomus angulatus* Carpenter \*\*\* Fig. 27

This is a seldom collected species known from ON south to VA with another population in AZ. It has only been taken west of the Blue Ridge in VA, usually at higher elevations. It has only been collected in the state in a relatively short time period: 6 May to 20 June.

Dickenson, Floyd, Rockingham, Tazewell, Wise Co's.

#### *Megalomus carpenteri* Penny, Adams & Stange Fig. 28

This is a recent name for the species previously known as *M. (or Boriomyia) speciosus* (Banks) which is preoccupied. It has only been recorded from FL, MD, and VA (Carpenter, 1940 from Falls Church). Although here recorded from a few localities in Virginia, they are all in the Coastal Plain or lower Piedmont. They have been captured in Malaise traps together with its congener *M. fidelis* in numbers from late May to early September.

Essex, Fairfax, Fauquier, Prince William Co's., Falls Church City.

#### *Megalomus fidelis* (Banks) Fig. 29

This species is closely related to the former and they often occur in the same Malaise trap collections. The species is widespread in the East: FL to TX and north to MN and ON with a record from BC. This is primarily a species of the Coastal Plain and Piedmont with a few records from west of the Blue Ridge. Collection dates range from mid-May into October.

Accomack, Charles City, Essex, Fairfax, Franklin, Henry, Isle of Wight, Montgomery, Northampton, Nottoway, Pittsylvania, Prince William, Rockingham, Southampton, Surry, Sussex, Wise Co's., Chesapeake,

Suffolk, Virginia Beach Cities.

#### Genus *Micromus* Rambur

Distributed in all faunistic regions of the world, this rather speciose genus is well represented in both the Afrotropical and Australian Regions, but lacking over most of the Neotropical (Monserrat, 1993). More than 100 species are recognized, often on remote oceanic islands in the Pacific, where they may have been brought by commerce. Eight species have been recorded from the USA and Canada (Klimaszewski & Kevan, 1988), with one also found as far south as Costa Rica and the Greater Antilles.

#### *Micromus montanus* Hagen

This is a widespread, boreal species recorded from AK and BC to Labrador, and south in the western mountains to CA and AZ and in the East south to NC and TN. In addition to the VA record from Whitetop Mtn. presented in Roble & Flint (2001), eight more records are presented here, four of which are also from Whitetop Mtn. and all from high elevations in the southern Blue Ridge or adjacent Appalachian Ridges. The collection dates range from late June to late September.

Grayson Co., Grayson Highlands State Park, hillside above Massie Gap trailhead parking area, N36.63200°, W81.50800°, 4681', 1 Sep 2011, S.M. Roble, UV, N hardwoods/red spruce, 1♀, NMNH; same but Haw Orchard Mtn., Cox Visitor Center, bus parking lot picnic area, 30 June 2011, S.M. Roble, UV, yellow birch-red spruce, 1♀, NMNH.

Grayson Co., Jefferson Natl. Forest, Whitetop Mountain, upper end of 2<sup>nd</sup> switchback of FS89 near summit, N36.63521°, W81.60331°, 30 Aug 2011, S.M. Roble, beech forest, UV, 1♀, NMNH.

Russell Co., Clinch Mtn. Wildlife Mgmt. Area, ~1mi. E Mutters Gap, 4200', 21 Sep 2011, S.M. Roble, uv, red spruce/northern hardwoods, 1♀, NMNH.

Smyth Co., Grindstone Campground, Jefferson Nat. For., 36°41.3' N, 81°32.4' W, 28 Sep 2005, O.S. Flint, Jr., 1♀, NMNH.

Smyth Co., Jefferson Natl. Forest, Whitetop Mountain, NW slope along App[alachian] Trail, N36.63907°, W81.60897°, 1600m., 30 Aug 2011, S.M. Roble, red spruce, UV, 1♀, NMNH; same, but 11 July 2012, 4♂, 2♀, NMNH.

Washington Co., Whitetop Mountain, 1600m, 12 Aug 1992, S.M. Roble & J.C. Ludwig, UV light, 1♀, VMNH.

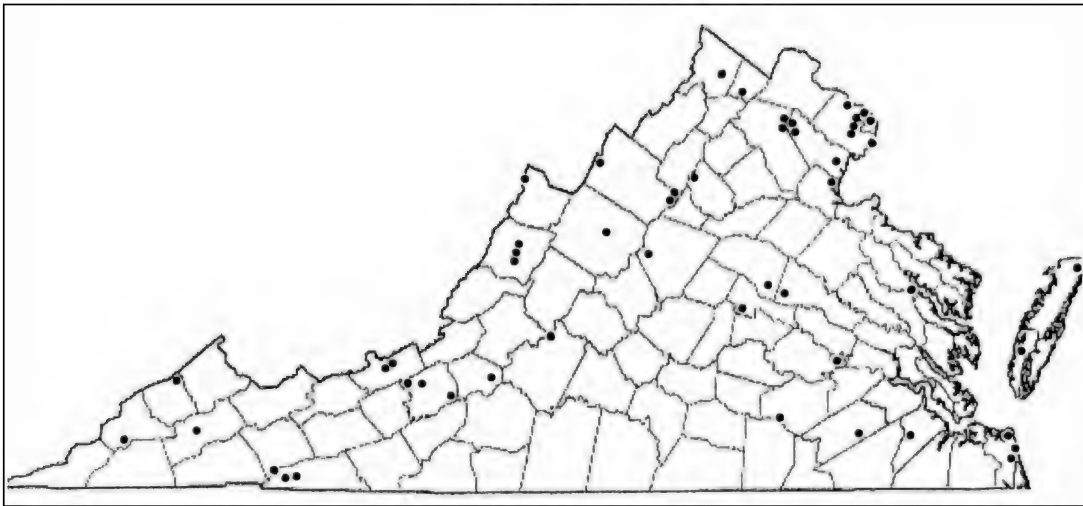


Fig. 25. Known distribution of *Hemerobius humulinus* Linnaeus in Virginia.

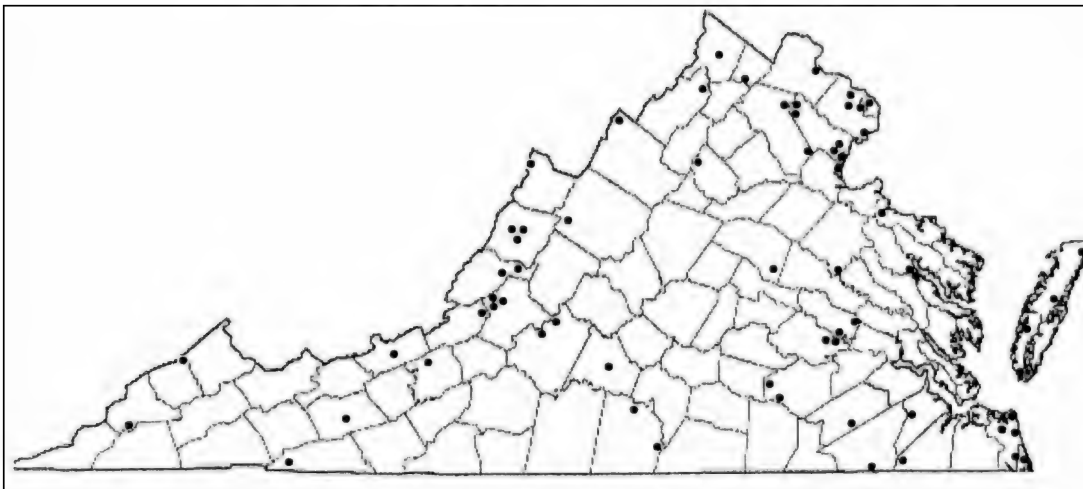


Fig. 26. Known distribution of *Hemerobius stigmaterus* Fitch in Virginia.

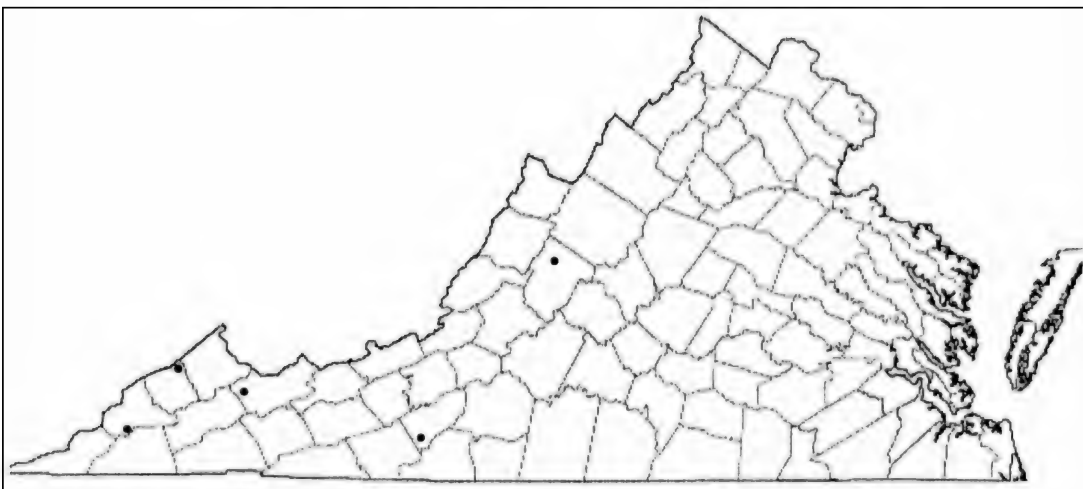


Fig. 27. Known distribution of *Megalomus angulatus* Carpenter in Virginia.

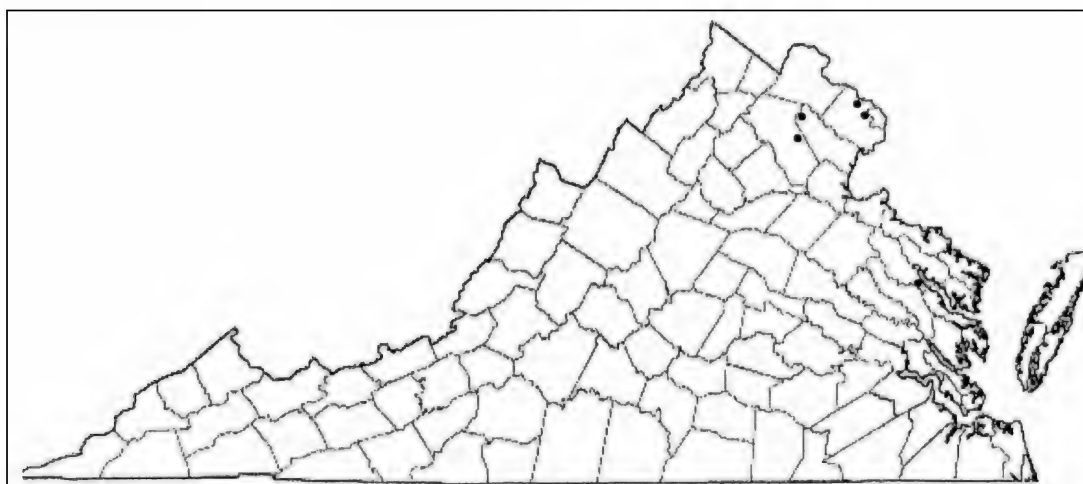


Fig. 30. Known distribution of *Micromus posticus* (Walker) in Virginia.



*Micromus posticus* (Walker) Fig. 30

This is primarily a species of eastern North America: FL to TX north to ND and QC with outlying western records from AZ, BC, and YK. It is widespread over the entire state of VA, and taken over most of the year. Considering the large numbers often taken in Malaise traps in early spring, it would seem that a large part of the population may overwinter as adults.

Accomack, Arlington, Augusta, Bedford, Chesterfield, Clarke, Dickenson, Essex, Fairfax, Fauquier, Floyd, Frederick, Giles, Grayson, Greenville, Henry, Isle of Wight, King & Queen, Loudoun, Louisa, Madison, Montgomery, Northampton, Prince William, Sussex, Warren, Wise Co's., Chesapeake, Franklin, Newport News, Richmond, Salem, Suffolk, Virginia Beach Cities.

*Micromus subanticus* (Walker) Fig. 31

This is primarily an eastern species, with an extension to AZ and CA, but not recorded farther north in the western mountains. It is otherwise recorded from FL to TX and north to the Canadian border in the USA, however it is now known from all across the southern reaches of Canada from BC to QC. The species has also been taken in the Greater Antilles on Cuba and Hispaniola. It is common in VA and found primarily on the Coastal Plain and Piedmont with two western records in Bath and Wise Co's. It is commonly taken in Malaise traps from late March to late October, but with one early January record.

Accomack, Arlington, Augusta, Bath, Bedford, Chesterfield, Dinwiddie, Essex, Fairfax, Fauquier, Gloucester, Greenville, Henrico, Montgomery, Northampton, Northumberland, Prince William, Southampton, Stafford, Westmoreland, Wise Co's., Suffolk, Virginia Beach Cities.

Genus *Psectra* Hagen

This is a relatively small genus of some two dozen species distributed primarily in Africa, southern Asia, Australia, and Oceania. One species is widespread across Europe, northern Asia, and northeastern North America. No species are known from the Neotropics or western North America.

*Psectra diptera* (Burmeister)

This is the only species known in North America and the northern Palearctic. In the New World it is known from VA west to IA and north to MI and NF. It is an interesting species in that both 2- and 4-winged

examples occur sporadically in both sexes in material from both sides of the Atlantic. Of the two examples currently available to me, one from Chatham is fully winged, but the one from Blacksburg possesses only vestigial hind wings. Carpenter (1940) mentions VA in its distribution, but gives no specific locality. The few VA examples I have seen are from the southwestern part of the state.

Montgomery Co., Blacksburg, 20 May 1948, E.W. King, 1♂, NMNH.

Montgomery Co., marl spring off Den Creek, Rte. 641, 3km S Ellett, 6-22 Jul 1999, S.M. Roble, Malaise, 1♂, VMNH.

Montgomery Co., 30 May 1962, Pienkowski, 1♀, VPISU.

Pittsylvania Co., Chatham, 26 Jul 1953, W. Tarpley, BL light trap, 1♀, NMNH.

Genus *Sympherobius* Banks

This is a fairly large hemerobiid genus consisting of 54 recognized species in 1988. Of these, the Palearctic contained 19 species, southern Africa one, and the New World 34 (Oswald, 1988). Since then, several more species have been described from the Neotropics. The species are widespread in North America, but with preponderance west of the Great Plains. Several are recorded from southern Canada.

*Sympherobius amicus* (Fitch) Fig. 32

This species is common east of the 100<sup>th</sup> Meridian: FL to TX, north to MN and NS, with western outliers recorded from AZ and CO. Surprisingly enough, in VA it is primarily recorded from the Coastal Plain and lower Piedmont, with a single record from high elevation in the southern Blue Ridge. It has been collected from late April into October, with a specimen taken in a house in mid-December.

Accomack, Arlington, Chesterfield, Dinwiddie, Essex, Fairfax, Fauquier, Grayson, Isle of Wight, Northampton, Prince William Co's., Falls Church, Virginia Beach Cities.

*Sympherobius barberi* (Banks)

The species is widely distributed across the USA and Mexico from coast to coast and as far north as OR, MN, and PA. It appears to have been introduced into Peru, Hawaii, and the Galapagos Islands. I have seen only a few state collections, all from the Coastal Plain, mostly in the southeastern corner of the state, but it has been recorded also from northern VA. They were collected from early April to early October.

Isle of Wight Co., Blackwater Ecol. Pres., 7km S Zuni, 4 Apr 1999, S.M. Roble, UV, 2♀, VMNH.

Isle of Wight Co., Antioch Pines Nat[ural]. Area [Preserve], 5km S Zuni, 4 Apr 1999, S.M. Roble, UV, 1♀, VMNH.

Virginia Beach City, False Cape State Park, Barbour Hill entrance road, south end of marsh, 31 May 2005, S.M. Roble, UV, 1♂, VMNH.

Virginia Beach City, False Cape State Park, main road, 0.6km S jct. with Barberry Hill Trail, 6 Oct 2005, S.M. Roble, UV, 1♀, VMNH.

Falls Church City (Carpenter 1940, MCZ).

### *Symphorobius occidentalis* (Fitch) Fig. 33

This species is found exclusively in eastern USA from GA to TX and north to WI and NY (Long Island). The VA localities are along the Coastal Plain and lower Piedmont, with one site in the far southwest. The collection dates range from late May to early October.

Accomack, Dickenson, Essex, Fairfax, Prince William Co's., Virginia Beach City.

### *Symphorobius umbratus* (Banks)

This species has a scattered distribution, mostly in the eastern USA from FL to OK and north to MO and PA. The type, however, is from central AZ, very far removed from the main range. I know of only three collections from VA: two from the lower Piedmont in northern VA in late June-early July, the other in the central Coastal Plain in mid-September.

Fairfax Co., Vienna, 20 Jun 1939 (Oswald 1988, but not now in NMNH).

Isle of Wight Co., Blackwater Ecological Preserve, ca. 4mi SSW of Zuni, Va. 614, 12 Sep 1995, D.J. Stevenson, 1♀, VMNH.

Prince William Co., Bull Run Mountain Conservancy, Jackson Hollow, campground field trap, 26 Jun-16 Jul 2013, D.R. Smith, Malaise Trap, 1♀, NMNH.

### Genus *Wesmaelius* Krüger

At least 70 species have been placed in this genus. It is widespread throughout the Holarctic Region and southern Africa, with one species known from Guatemala and another introduced into New Zealand. In the latest revision, Klimaszewski & Kevan (1987) recognized 14 species in the genus from North America. Many of the species have boreal distributions but others are restricted to the drier western mountain states, and one species in the East ranges down the mountains to NC.

### *Wesmaelius nervosus* (Fabricius)

This is a very widely distributed, Holarctic species, including Greenland, Iceland, and the Faroe Islands. In the New World its distribution is primarily the boreal area of Alaska and Canada south into the Rocky Mts. as far as CO and UT and in the east to IN and NC. The Madison Co. specimen was the first example of the species recorded from VA (Roble & Flint, 2001), but more recently a series has been taken along the ridge of Warm Springs Mtn. These few collections were made from late May to early July.

Bath Co., Warm Springs Mountain, 6 collections along the ridge between 1 June and 7 July 1999, J.C. Ludwig, 12♀, VMNH.

Madison Co., Hog Camp Brook, Shenandoah Nat. Pk., 22-23 May 1970, O.S. Flint, Jr., 1♀, NMNH.

### Family Mantispidae

This is a moderately large Neuropteran family, often called mantis- or mantidflies, with 410 modern species recognized and placed in 44 genera (Ohl, 2004). They are found in all zoogeographic regions of the world. The New World contains 114 of these, of which 20 are recorded from the Nearctic Region (Hoffman, 1992). Many species are parasites on spider eggs (generally in their egg sacs) or on immature aculeate Hymenoptera.

### Genus *Climaciella* Enderlein

The genus *Climaciella* is exclusively New World in distribution and contains nine described species. They are found from northern Argentina to southern Canada, including three of the Greater Antillean islands. The one North American species is quite variable in appearance and found south to Costa Rica. Opler (1981) described five color forms from Costa Rica and listed their possible wasp models.

### *Climaciella brunnea* (Say) \*\*\* Fig. 34

Although this species is recorded all across the continent, FL to CA and north to BC and QC, it seems to have never been specifically recorded from VA. The VA records are from the southern half of the state, but from the Coastal Plain to the Alleghenies. The lack of records from northern VA is puzzling. The few VA collections have been made from late May to late October.

Botetourt, Dickenson, Pittsylvania Co's., Chesapeake, Virginia Beach Cities.

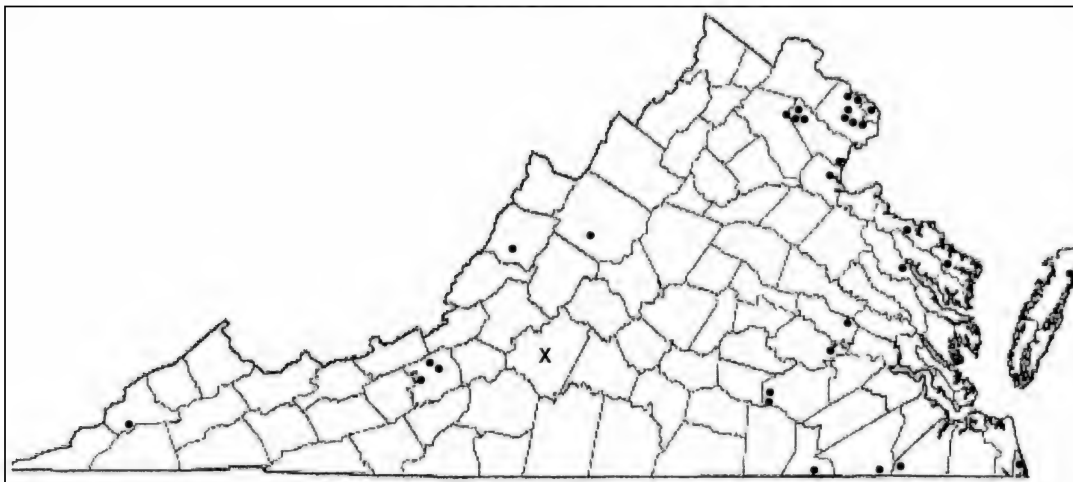


Fig. 31. Known distribution of *Micromus subanticus* (Walker) in Virginia.

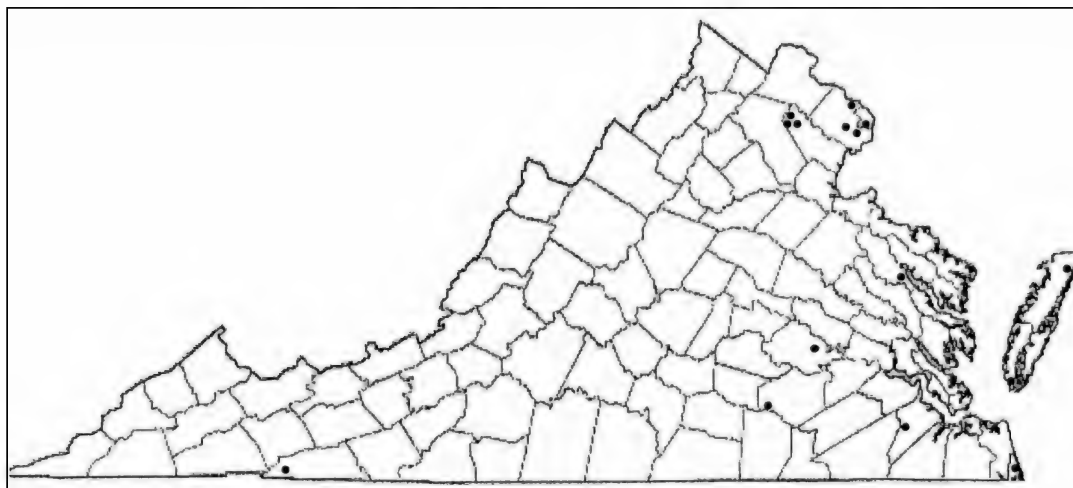


Fig. 32. Known distribution of *Sympherobius amicus* (Fitch) in Virginia.

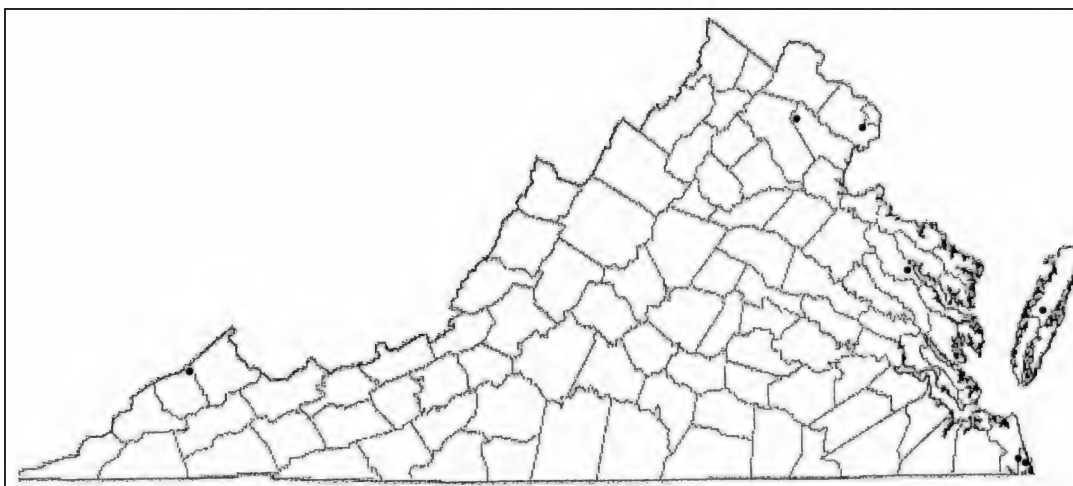


Fig. 33. Known distribution of *Sympherobius occidentalis* (Fitch) in Virginia.



Genus *Dicromantispa* Hoffman

This exclusively New World genus contains five described species, two of which enter the USA and VA. Species are recorded from Argentina to southern Canada, including the Bahamas and the Greater Antilles.

*Dicromantispa interrupta* (Say)

This is a widespread, primarily eastern species recorded from SC to TX, north to KS, MN, and QC, with a CO record and is widespread in Mexico. I have seen only one specimen from Virginia, but there is an earlier record (Hagen, 1861) that only mentions the state.

[Amherst Co.]. BRP [Blue Ridge Parkway], MP 55, 17 Aug 1993, S.M. Roble, UV, 1♀, VMNH.

*Dicromantispa sayi* (Banks) \*\*\* Fig. 35

Another eastern species, it is found as far west as AZ and UT and north to MN and CT. It is also known from south of the USA to Panama and the Greater Antilles and Bahamas. There does not seem to be any published VA record. Most of the VA records are from east of the Blue Ridge, but several are from the vicinity of Blacksburg, Montgomery Co. They have been collected from mid-June to mid-October.

Arlington, Charles City, Clarke, Fauquier, Montgomery, Prince William Co's., Alexandria, Virginia Beach Cities.

Genus *Leptomantispa* Hoffman

Like the two preceding genera, this is a rather small genus of three described species, exclusively of New World distribution. They are found from Brazil north to southern Canada.

*Leptomantispa pulchella* (Banks) \*\*\* Fig. 36

This small species has a spotty distribution from SC to UT and north to IL and, now, VA. The few VA collections are scattered widely across the state. The collections are from late June to early October.

Bath, Essex, Wythe Co's., Virginia Beach City.

Genus *Zeugomantispa* Hoffman

As with the preceding genera, this one is small, consisting of three described species, and of exclusively New World distribution. The species are found from

Argentina and Brazil north to Mexico, with one species widely distributed in the USA.

*Zeugomantispa minuta* (Fabricius)

Fig. 37 and back cover photo

This is the species long called *Mantispa viridis* Walker. In the USA, it is found in the East: FL to TX and north to WI and VA, but it also ranges south to Argentina and some of the Greater Antillean islands. This species is widely distributed across the Coastal Plain and Piedmont in VA, with several records west of the Blue Ridge. Although most records are from late July through early November, there are a few records as early as late May.

Accomack, Bath, Chesterfield, Culpeper, Essex, Fairfax, Fauquier, Franklin, Henrico, King George, King & Queen, Loudoun, Middlesex, Montgomery, New Kent, Richmond, Rockbridge, Spotsylvania, Wise, York Co's., Alexandria, Hampton, Radford, Roanoke, Suffolk, Virginia Beach Cities.

## Family Myrmeleontidae

The Myrmeleontids, or antlions, contain probably the most described species of any Neuropteran family. They are found in all faunal regions of the world, and are most diverse in the drier ones. The recent world catalog (Stange, 2004) lists 1,522 extant species placed in 201 genera. In the New World we have at least 45 genera and 245 species, of which 18 genera and 92 species are known from north of Mexico. Many of these latter genera and species are limited to the more arid southwestern parts of the USA. In VA we only have 11 species placed in seven genera.

Genus *Brachynemurus* Hagen

The genus is widely distributed in Mexico, USA, and southern Canada. Some 21 species are recorded from north of the Mexican border, four of which are found in VA. Their larvae do not make pits and are found in open sand and may run fast to catch their prey.

*Brachynemurus abdominalis* (Say) Fig. 38

This is the most widely distributed antlion in North America, being found from coast to coast and north into the southern Canadian provinces. It is equally widespread in VA, but collected much less frequently west of the Blue Ridge. It has been taken from early May to late September.

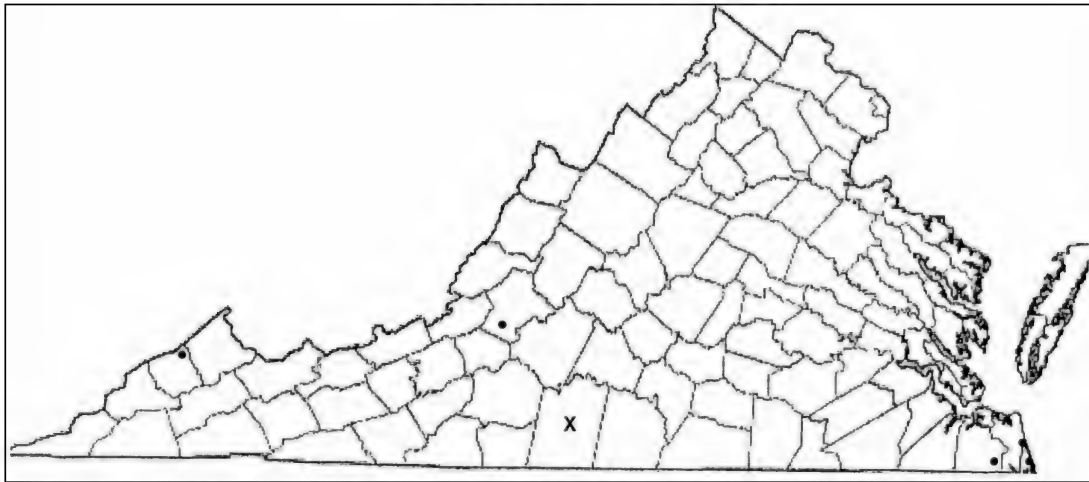


Fig. 34. Known distribution of *Climaciella brunnea* (Say) in Virginia.

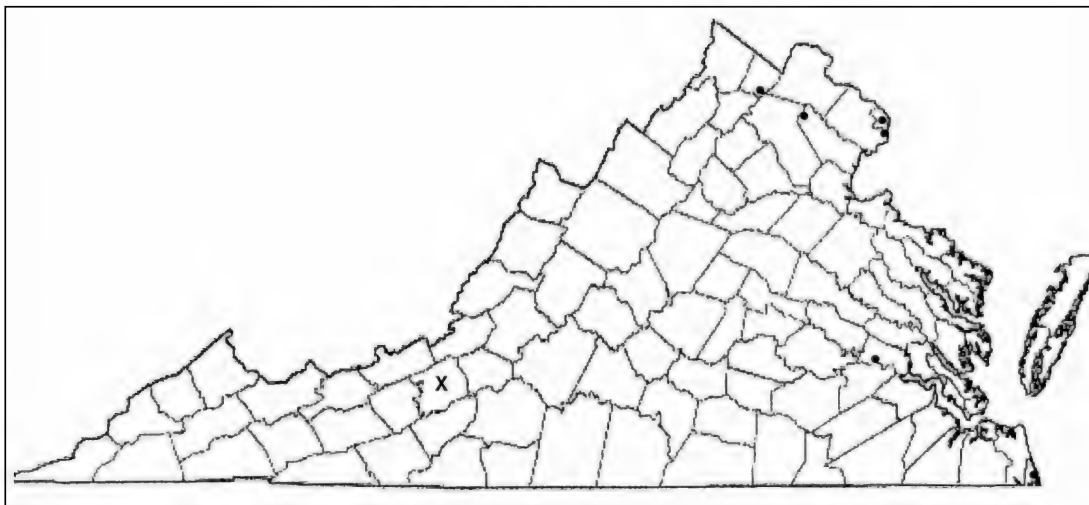


Fig. 35. Known distribution of *Dicromantispa sayi* (Banks) in Virginia.

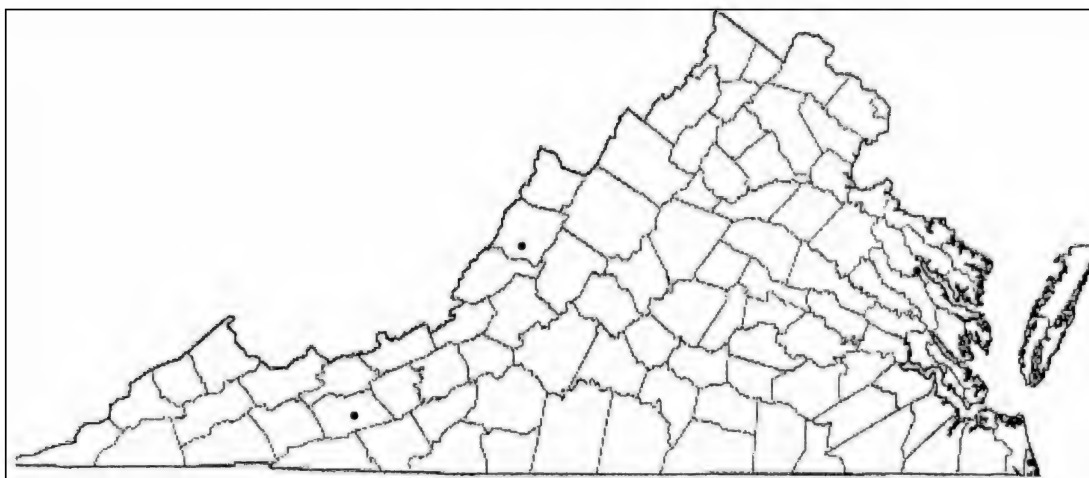


Fig. 36. Known distribution of *Leptomantispa pulchella* (Banks) in Virginia.

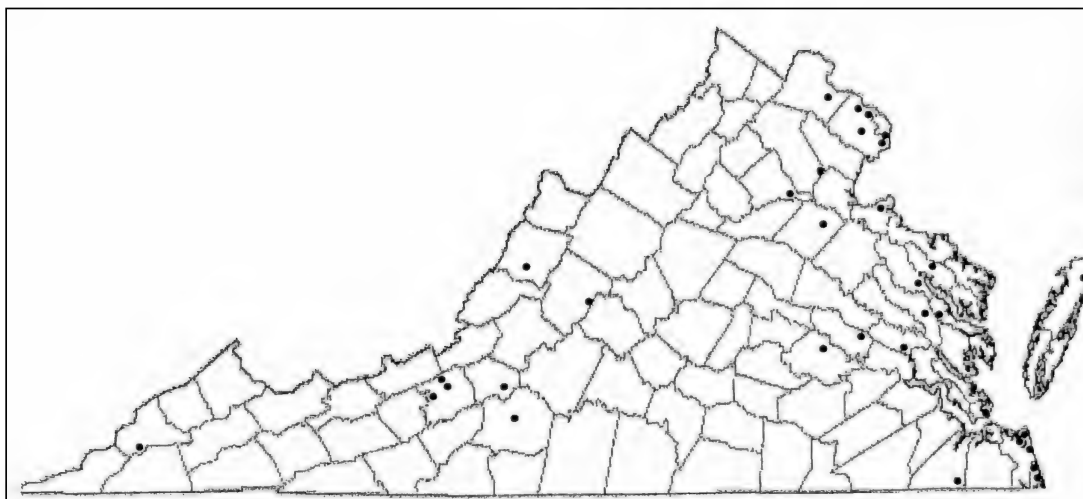


Fig. 37. Known distribution of *Zeugomantispa minuta* (Fabricius) in Virginia.

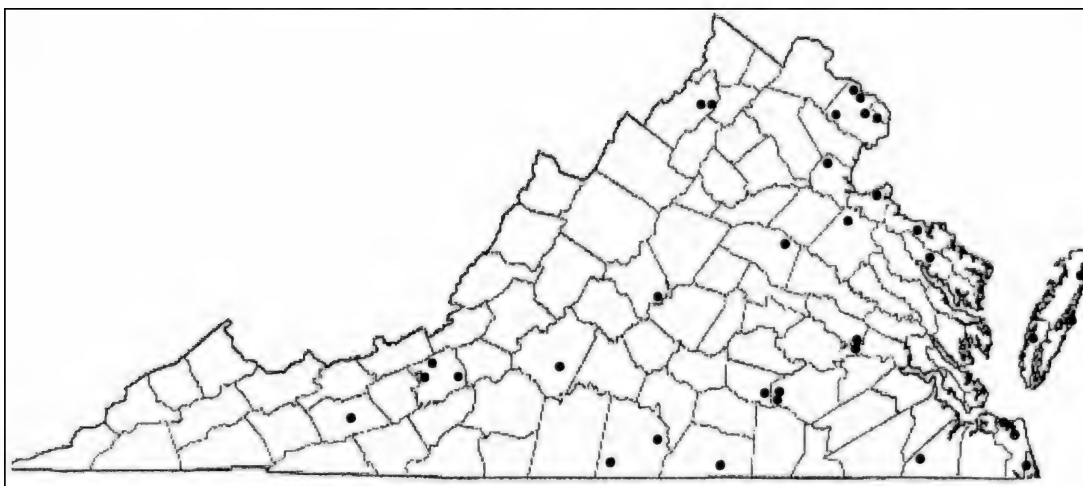


Fig. 38. Known distribution of *Brachynemurus abdominalis* (Say) in Virginia.

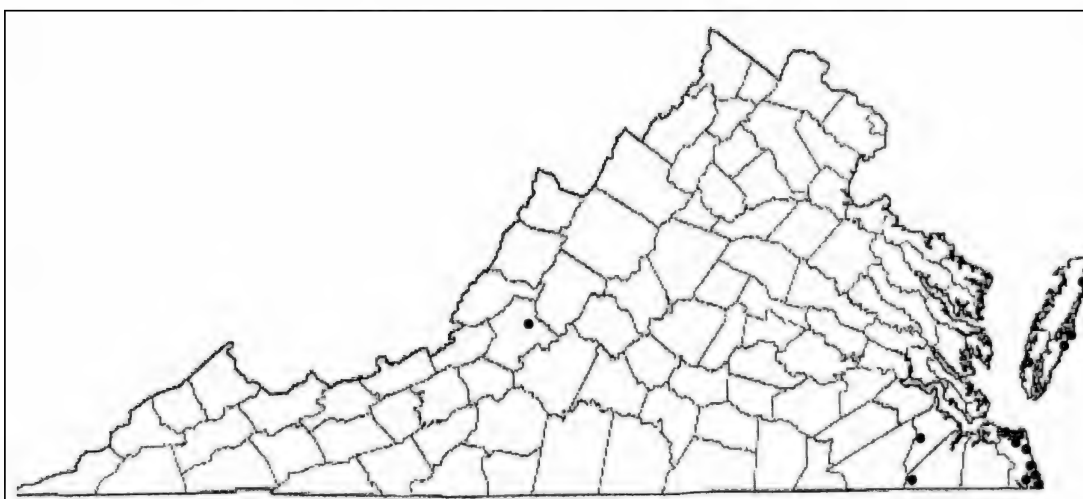


Fig. 39. Known distribution of *Brachynemurus longicaudus* (Burmeister) in Virginia.

Accomack, Arlington, Bedford, Caroline, Chesterfield, Dinwiddie, Fairfax, Halifax, King George, Louisa, Mecklenburg, Montgomery, Nelson, Northampton, Nottoway, Richmond, Shenandoah, Stafford, Suffolk, Westmoreland, Wythe Co's, Falls Church, Norfolk, Richmond, Virginia Beach Cities.

*Brachynemurus longicaudus* (Burmeister) Fig. 39

This species has a distribution restricted to east of the Mississippi River: FL to MS north to IN and NJ. It is almost exclusively found in the outer coastal Plain in VA, but with a single record from west of the Blue Ridge. The flight season appears to extend from early June to early September.

Accomack, Botetourt, Isle of Wight, Northampton Co's., Norfolk, Suffolk, Virginia Beach Cities.

*Brachynemurus nebulosus* (Olivier) \*\*\* Fig. 40

This is another primarily eastern species, but it ranges farther west and north than *B. longicaudus*: FL to TX and north to MI and ON. In VA it is strictly a coastal species that does not seem to have been recorded from the state previously. I have seen a total of 19 specimens from four counties and cities, including Accomack Co. (1), Northampton Co. (3), Suffolk City (2), and Virginia Beach City (13). They were collected from late April to early October.

Accomack, Northampton Co's., Suffolk, Virginia Beach Cities.

*Brachynemurus signatus* (Hagen) \*\*\*

This species has a much more northerly distribution in eastern USA than the previous two: VA west to CO and north to ND and RI. In VA it has only been taken in company with *B. nebulosus* in two coastal jurisdictions: five collections from Accomack Co., and nine from Virginia Beach City. The earliest date is 20 June, the latest 19 September.

Accomack Co., Virginia Beach City.

Genus *Chaetoleon* Banks

This is a small genus of four species all limited to North America. Three of the species are found in the west or southwestern regions and adjacent Mexico. The fourth, *C. pumilis*, is found in southeastern USA. The larvae of the closely related western species, *C. pusillus* Currie, are found in sand under plants (Stange, 1994).

*Chaetoleon pumilis* (Burmeister) \*\*\*

This species is rather infrequently collected. In his revision of the Brachynemurini, Stange (1970) only saw one male and seven females of *C. pumilis*. It is reported from FL, GA, NC, and SC. There is an early record from Staten Island, NY (Smith, 1900), but this seems to be currently discounted because it is not repeated in recent revisions. However, with the discovery of *C. pumilis* in southeastern Virginia, that record seems more plausible. It is a small, distinctively marked species and unlike any other regional species.

City of Suffolk, South Quay pine barrens, 10km S of Franklin, Area 50, 24 May 2004, S.M. Roble, UV, 1♂, NMNH.

Genus *Dendroleon* Brauer

This genus is very widespread, being known from all continents in the Old World, but only North America in the New World. Nineteen species have been described in the genus, but only two of these are known from the USA in the New World. Of the latter, one species is widespread over eastern North America.

*Dendroleon obsoletus* (Say) Fig. 41

The species is widespread in eastern USA: FL to KS and north to MI and CT. Their larvae do not dig pits, but live on logs and trunks and are trash bearers (Stange, 1980). They seem to be found all across the state and are most common in wooded areas. There is one early record from 21 March, and it has only rarely been taken in June: most records are from July through early October.

Arlington, Augusta, Chesterfield, Clarke, Craig, Fairfax, Fauquier, Floyd, Frederick, Giles, Hanover, Henrico, Henry, Montgomery, Nelson, Northampton, Page, Prince Edward, Prince William, Roanoke, Shenandoah, Stafford, Washington, Wise Co's., Alexandria, Fairfax, Falls Church, Hampton, Lynchburg, Williamsburg Cities.

Genus *Euptilon* Westwood

This is a relatively small New World genus of five species. For a long time the species of this genus were placed in *Psammoleon*, which genus has now been divided into two genera, this one, and *Purenleon* with the other 15 species. The species of *Euptilon* are found mostly in the USA with one also found in adjacent Mexico. Their larvae live in sand, generally mixed with debris at the bases of trees (Stange, 1980).



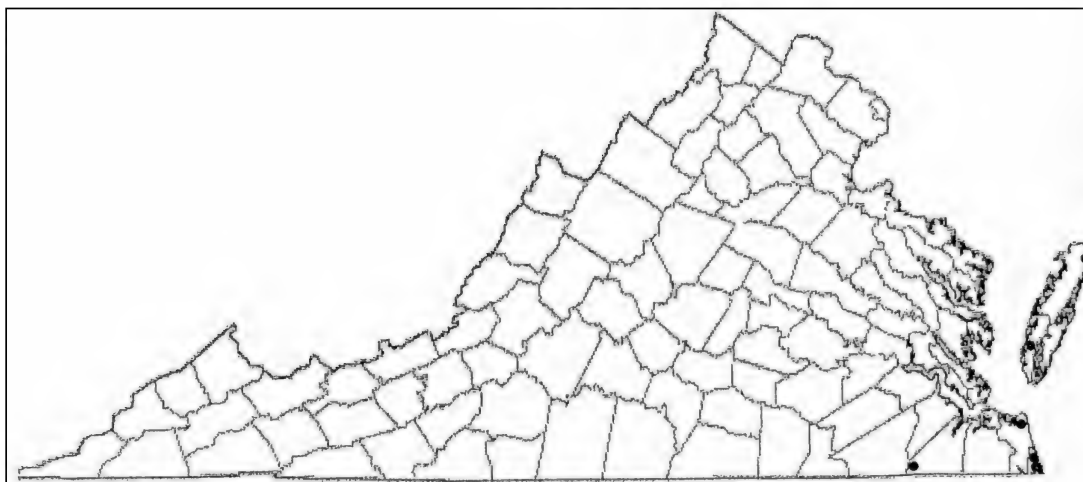


Fig. 40. Known distribution of *Brachynemurus nebulosus* (Olivier) in Virginia.

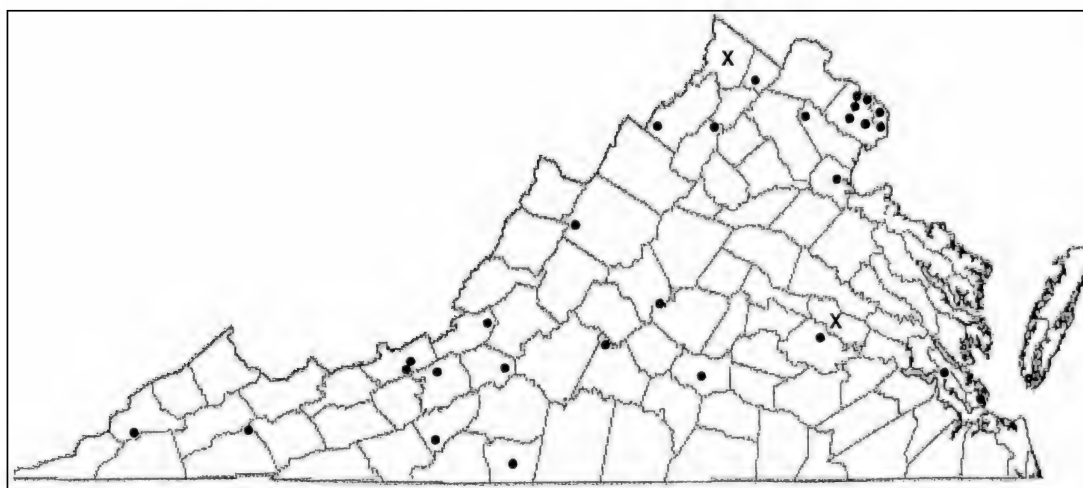


Fig. 41. Known distribution of *Dendroleon obsoletus* (Say) in Virginia.

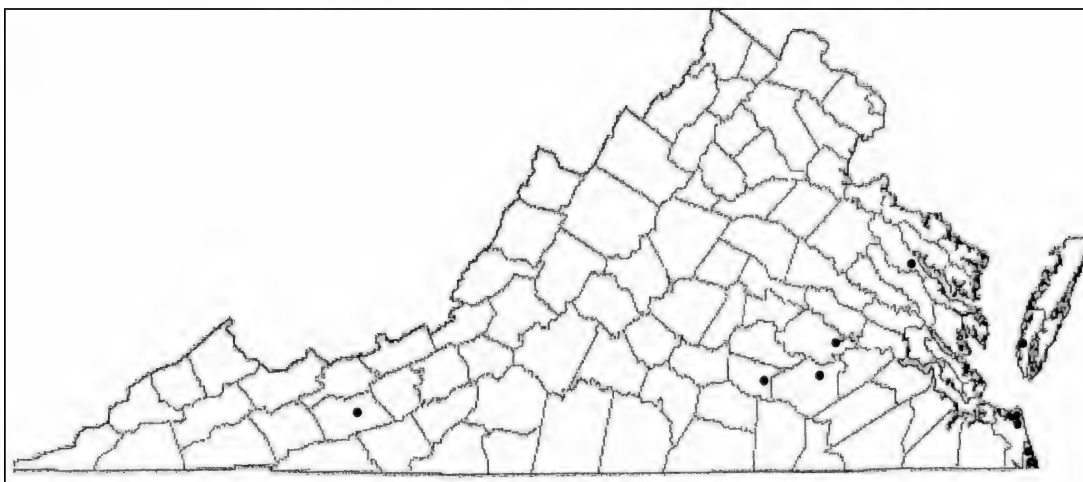


Fig. 42. Known distribution of *Euptilon ornatus* (Drury) in Virginia.

*Euptilon ornatus* (Drury) = *Psammoleon guttipes* (Banks) of authors Fig. 42

Only recently (Stange, 2004) has the type of *E. ornatus* been recognized and it is the senior synonym of the long-used *P. guttipes*, resulting in this name change. The type locality for *E. ornatus* is Dinwiddie, VA, but the type specimen is missing. The species is eastern, being known from FL west to TX and north to MO and NJ. Most VA records are from the Coastal Plain and Piedmont, with one from the Alleghenies. Other than the type, there were no previous VA records. They have been collected from early June to mid-August.

Chesterfield, Dinwiddie (type locality of *E. ornatus*), Essex, Northampton, Nottoway, Wythe Co's., Virginia Beach City.

#### Genus *Glenurus* Hagen

This exclusively New World genus contains nine described species distributed from Argentina well into the USA. Three of these species are found north of Mexico, but two are limited to the western part of the country.

*Glenurus gratus* (Say) \*\*\* Fig. 43

This large and spectacular species can probably be found over most of the state, but it is rarely seen. It was not previously recorded from VA. The larvae live in tree holes, rodent burrows, and rotting wood where they feed on small insects often attracted to the feces of the animal inhabitants (Miller & Stange, 1983). One larva was taken in April in Prince Edward Co. from "berleseat rotten wood". Adults have been taken from late July with a late record of 22 October.

Arlington, Chesterfield, Culpeper, Fairfax, Henrico, King George, Lee, Montgomery, New Kent, Prince Edward, Prince William, Scott Co's.

#### Genus *Myrmeleon* Linnaeus

This cosmopolitan genus of 176 described species is the largest genus in the family. Of these, 33 species are recorded from the New World. There are 12 species currently recognized in the USA, but the genus is currently being revised with the likelihood that this number will change. Only two species are known from the state, and I believe they are correct in light of this aforementioned study.

*Myrmeleon crudelis* Walker Fig. 44

This is an eastern species known from FL to TX and

north to MO and NY. In VA it is a species of the Coastal Plain and adjacent Piedmont. It has been taken from late May to early October, but is most frequent in July and August.

Accomack, Caroline, Essex, Isle of Wight, Mecklenburg, Northampton, Sussex Co's., Hampton, Suffolk, Virginia Beach Cities.

*Myrmeleon immaculatus* DeGeer Fig. 45

This is a common eastern species found from FL to OK and north to MI and NH. In VA it has been taken from the Coastal Plain through the Alleghenies and from Southside north to the Potomac River. It is the most common pit-making species in the state. Adults have been collected from late May to early October.

Alleghany, Amherst, Arlington, Charles City, Essex, Fairfax, Fauquier, Floyd, Frederick, Isle of Wight, Montgomery, Nelson, Powhatan, Prince William, Pulaski, Roanoke, Stafford, Sussex, Washington Co's., Lynchburg, Radford, Richmond, Suffolk, Virginia Beach Cities.

#### Genus *Vella* Navás

This is another small, exclusively New World genus. Five species are recognized, but one exists in two recognized forms. These are the largest antlion found in the New World. Their larvae are interesting in that they can only move backward, and they burrow in the sand, often leaving recognizable surface trails (Stange, 1980). They can move quite fast, and may consume larvae of other antlions.

*Vella americana* (Drury) Fig. 46

This species is limited to the southeastern USA: FL north along the coast to NJ and NY. All VA records are coastal except for an inland population documented at the South Quay pine barrens in Suffolk City. Collection dates range from early July to early September.

Accomack, Northampton, Westmoreland Co's., Suffolk, Virginia Beach Cities.

#### Family Sisyridae

The Sisyridae, or spongillaflies, are interesting because their larvae are wholly aquatic and feed on freshwater sponges. There are four genera and around 70 species currently known from all the major faunal regions. In the New World two genera and 30 species are described, both genera and six species have been recorded from north of the Mexican border (Parfin &

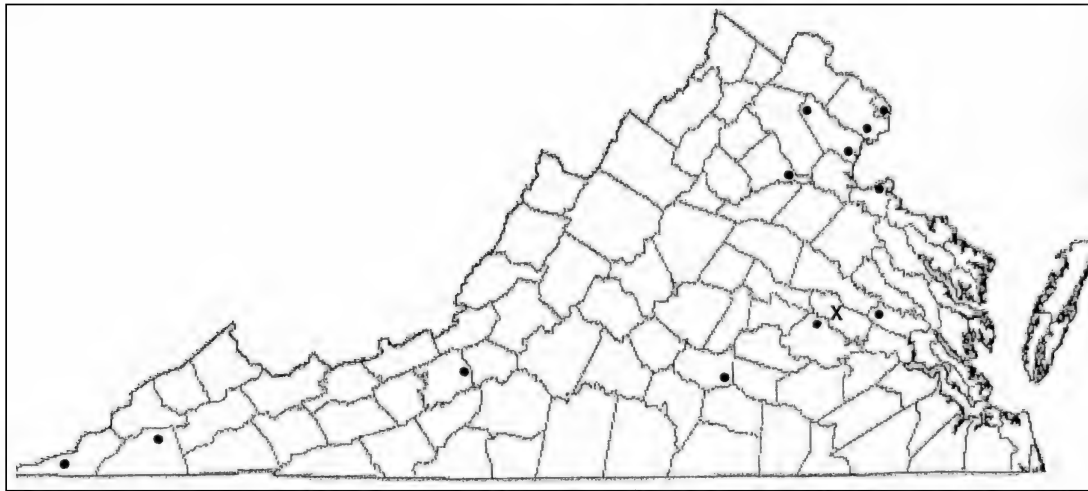


Fig. 43. Known distribution of *Glenurus gratus* (Say) in Virginia.

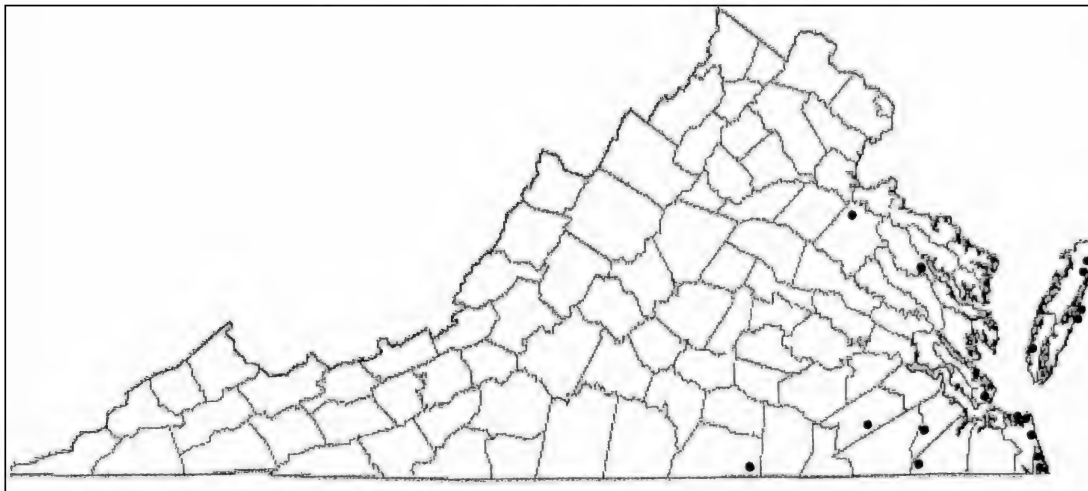


Fig. 44. Known distribution of *Myrmeleon crudelis* Walker in Virginia.

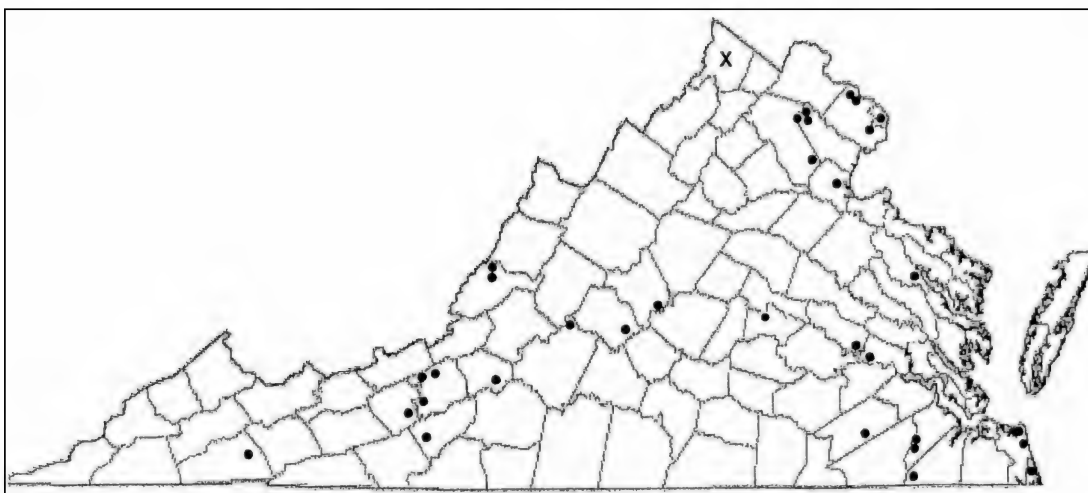


Fig. 45. Known distribution of *Myrmeleon immaculatus* DeGeer in Virginia.

Gurney, 1956; Bowles, 2006).

Genus *Climacia* McLachlan

This is an exclusively New World genus containing 21 described species (Flint, 1998, 2006). Three species are known from Canada and the USA, but all also occur in Mexico. Two of the species are limited to the western states and Mexico, but the other is widespread in eastern North America.

*Climacia areolaris* (Hagen) Fig. 47

This species seems to be limited to east of the 100<sup>th</sup> Meridian: FL west to TX and north to MI, ON, and ME with a questionable record from CO. The VA records are from the Coastal Plain and Piedmont, right up to the Blue Ridge on the New River. Bowles (2006) reported the species from Louisa Co. based on a specimen in the Brigham Young University (BYU) collection, but further investigation reveals that it was mislabeled and the collection site is actually in Hanover Co. Capture dates of *C. areolaris* in VA range from late April into October.

Amherst, Caroline, Carroll, Chesterfield, Clarke, Fairfax, Greensville, Halifax, Hanover, Isle of Wight, King & Queen, New Kent, Prince George, Prince William, Sussex Co's., Chesapeake, Fairfax, Suffolk, Virginia Beach Cities.

Genus *Sisyrha* Burmeister

This cosmopolitan genus is found across Europe, Asia, Africa to Australia and throughout the New World and contains over 40 described species. In the New World nine species are known with three found north of Mexico (Flint, 2006). *Sisyrha nigra* (Retzius) (= *S. fuscata* [Fabricius]) is also found throughout Europe and northeastern North America.

*Sisyrha apicalis* Banks \*\*\*

This is a widespread tropical species, previously known from southeastern USA (FL to TX and north to NC), Cuba, and south through Central America into central Brazil. It does not seem to have been taken in VA before. As might be expected from its distribution, it enters the state only in the southeastern corner.

Isle of Wight Co., Blackwater Ecological Preserve, 7km S Zuni, 12 Jul 1994, S.M. Roble, 1♂, VMNH.

Isle of Wight Co., Antioch Pines Nat[ural]. Area [Preserve], 10km S Zuni, 3 Oct 2003, S.M. Roble, UV, unburned unit, 1♀, VMNH.

Suffolk City, South Quay, 6mi S Franklin, 4 Sep

2002, Roble & Hobson, UV, pine barrens, 1♂, 1♀, VMNH.

*Sisyrha vicaria* (Walker) Fig. 48

This is primarily an eastern species recorded from FL to TX and north to MI and NS, but there is also a northwestern range from OR to BC. All but one of the VA records are from the Coastal Plain and lower Piedmont; the other record is from the Blue Ridge. It has been collected in the state from mid-April to early October.

Amherst, Caroline, Fairfax, Greensville, Hanover, Henrico, Isle of Wight, Middlesex, Northampton, Southampton, Sussex Co's., Chesapeake, Norfolk, Suffolk, Virginia Beach Cities.

## ORDER MEGALOPTERA

### Family Corydalidae

The corydalids, or variously known as fishflies, dobsonflies, or hellgrammites, are a small order of neuropteroid insects whose larvae are aquatic. The adults are large and frequently attracted to lights or seen flying slowly over streams and rivers. There are over 335 species placed in 26 genera (Yang & Liu, 2010). They are found over the entire world with the exception of the frozen regions, and, surprisingly, Europe. The New World contains 15 genera and 106 described species, of which eight genera and 22 species are found north of Mexico.

### Genus *Chauliodes* Latreille

This small genus only contains two species, both found in VA. Both are widespread in eastern North America, west to the 100<sup>th</sup> Meridian.

*Chauliodes pectinicornis* (Linnaeus) Fig. 49

This is a common species, often attracted to lights. Its range is from FL to TX and north to MI and east to the Atlantic, but only recorded in Canada from BC. Its larvae live in small to medium-sized streams, but one larva was found in a water-filled tree-hole near Williamsburg (Fashing, 1994). This species is found all across VA, from late May to early October.

Accomack, Amherst, Arlington, Augusta, Bedford, Caroline, Carroll, Charles City, Chesterfield, Clarke, Essex, Fairfax, Floyd, Frederick, Giles, Halifax, Highland, King & Queen, Lancaster, Loudoun, Louisa, Madison, Montgomery, Nelson, Northumberland,



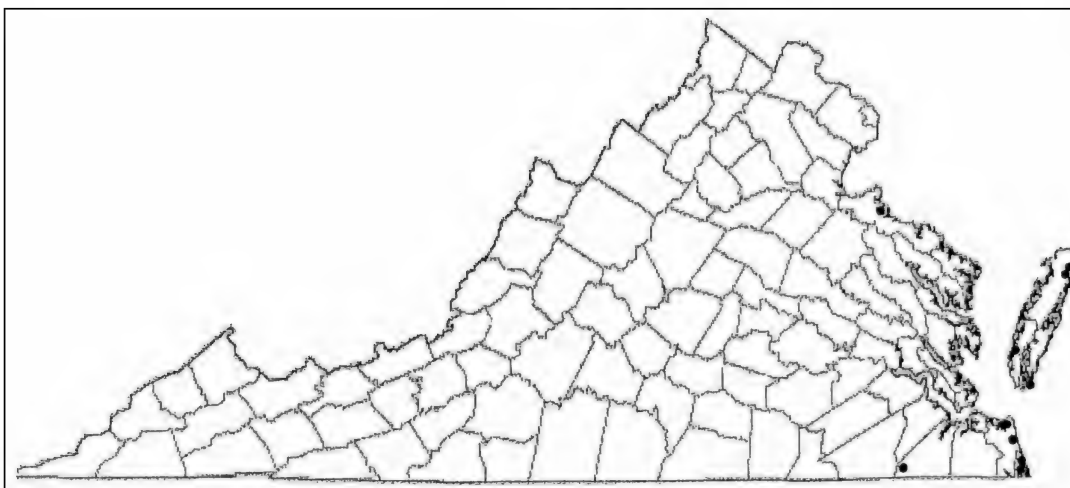


Fig. 46. Known distribution of *Vella americana* (Drury) in Virginia.

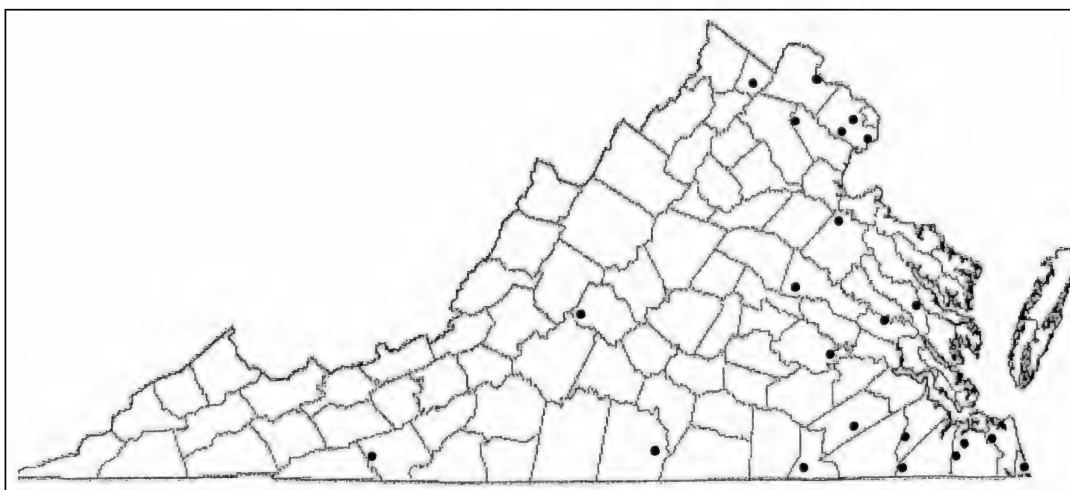


Fig. 47. Known distribution of *Climacia areolaris* (Hagen) in Virginia.

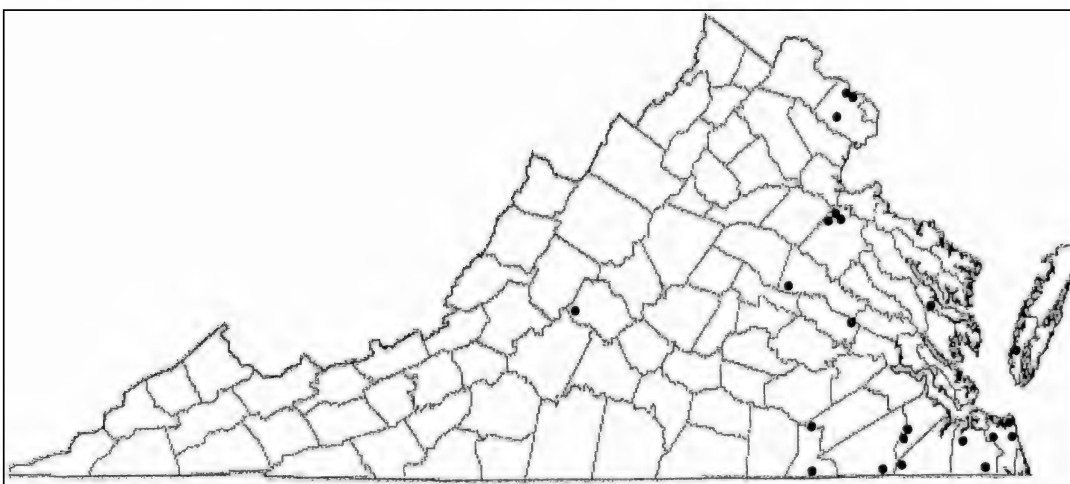


Fig. 48. Known distribution of *Sisyrha vicaria* (Walker) in Virginia.

Nottoway, Page, Prince William, Richmond, Russell, Shenandoah, Smyth, Southampton, Stafford, Sussex, Tazewell, Wise Co's., Chesapeake, Lynchburg, Richmond, Suffolk, Virginia Beach Cities.

*Chauliodes rastricornis* (Rambur) Fig. 50

This species has a similar distribution to the previous one: from the Atlantic to KS, IA, and MN north to the Canadian border. Although their larvae are aquatic, they frequent mostly standing water and even small, permanent, stagnant pools. It does not range as widely across VA as *C. pectinicornis*, being found mostly east of the Blue Ridge. Tarter et al. (1976) add Greensville and New Kent Co's., and Suffolk City, to the list of jurisdictions below. It flies from early April to late September.

Accomack, Amherst, Charles City, Chesterfield, Essex, Fairfax, Floyd, Henry, Louisa, Middlesex, Northampton, Powhatan, Sussex Co's., Chesapeake, Norfolk, Portsmouth, Suffolk, Virginia Beach Cities.

Genus *Corydalus* Latreille

This is a fairly large, New World genus with over 30 species (Contreras-Ramos, 1998) known from southern Canada to central Argentina, but not in the West Indies. The larvae live in flowing water, both smaller streams and large rivers, but usually in areas with fast flow. The larvae may take three or more years to mature. Four species enter the USA, but three are limited to the Southwest.

*Corydalus cornutus* (Linnaeus) Fig. 51

This is the insect known as the dobsonfly as an adult and hellgrammite as a larva. The large males are one of the most spectacular Eastern insects with a wingspread of up to 5.5 inches and mandibles up to 1.5 inches long. Actually the females with much shorter mandibles are capable of a more severe bite. It is known from southeastern Canada south and west to TX, NM, and the eastern Great Plains and north to MN. Most VA records are from the Coastal Plain and Piedmont with a few scattered records from west of the Blue Ridge. The dates extend from early June to early August with a few anomalous dates in mid-April and mid-November.

Albemarle, Amherst, Appomattox, Arlington, Bath, Bedford, Campbell, Charlotte, Chesterfield, Culpeper, Dickenson, Dinwiddie, Fairfax, Frederick, Giles, Henry, Lee, Loudoun, Montgomery, Nelson, Nottoway,

Prince Edward, Pulaski, Rockbridge, Russell, Shenandoah, Sussex Co's., Alexandria, Richmond, Suffolk, Virginia Beach Cities.

Genus *Neohermes* Banks

This rather small New World genus is comprised of five described species, three from the East and two exclusively western (Flint, 1965). Here are recorded two species, but there is a good deal of variation in the male genitalia between individuals, and I am unable to see discrete morphs, leading me to believe it is simple variability.

*Neohermes concolor* (Davis) Fig. 52

This species is found east of the 100<sup>th</sup> Meridian: GA to OK, north to IL and VT. The VA records are scattered across the state. They are on the wing from early June to early September.

Bedford, Brunswick, Charles City, Chesterfield, Craig, Dinwiddie, Essex, Fairfax, Fauquier, Loudoun, Montgomery, Nottoway, Prince William, Rockbridge Co's., Hampton, Suffolk Cities.

*Neohermes matheri* Flint \*\*\*

This species had only been known from MS, thus its presence in VA is quite surprising. Although the terminalia match those from MS, it might still be an extreme variation of the preceding species. Only two lots have been taken from the southern counties in the state.

Halifax Co., Difficult Creek N[atural] A[rea] P[reserve] [5-6km E Scottsburg, at Rt. 719 & Difficult Creek], forest unit 2/3, N36.7542°, W78.7202°, 17 June 2014, A.C. Chazal, UV, 4♂, 2♀, NMNH; same but N36.75293°, W78.72851°, 1♂, 1♀, NMNH.

Virginia Beach City, Camp Pendleton Annex, vic. NW jct. S Birdneck & Washington Rds., 36.81385° N, 75.97079° W, 24-25 Jun 2009, A.V. Evans, UV light trap, 1♂, NMNH.

Genus *Nigronia* Banks

This is another small, exclusively New World genus. Only two species are known, both from east of the 100<sup>th</sup> Meridian. Neither was listed for VA by Penny et al. (1997), but Tarter et al. (1976) mapped both for the state without further details. Both species inhabit spring runs up to small streams, and may be taken together. They are commonly seen during the day, fluttering slowly over the water and adjacent land.

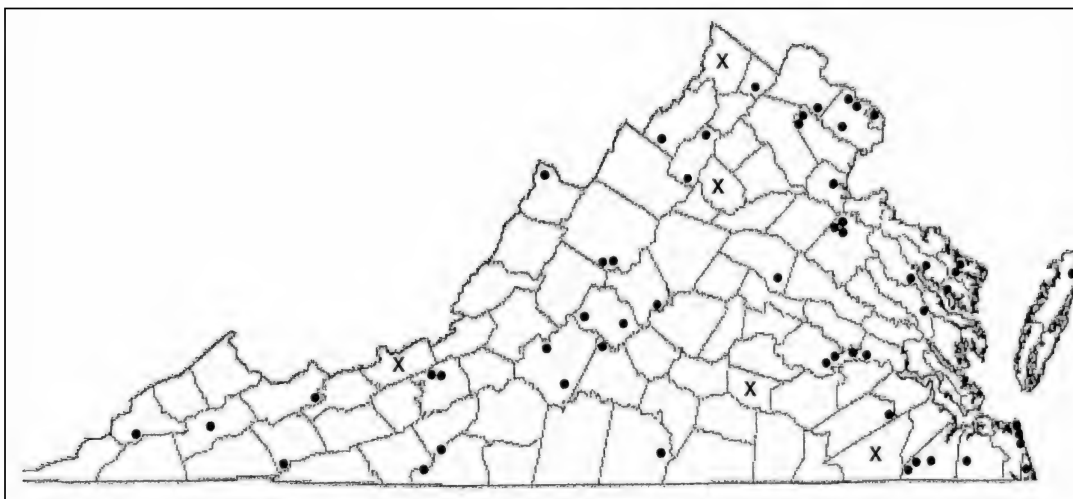


Fig. 49. Known distribution of *Chauliodes pectinicornis* (Linnaeus) in Virginia.

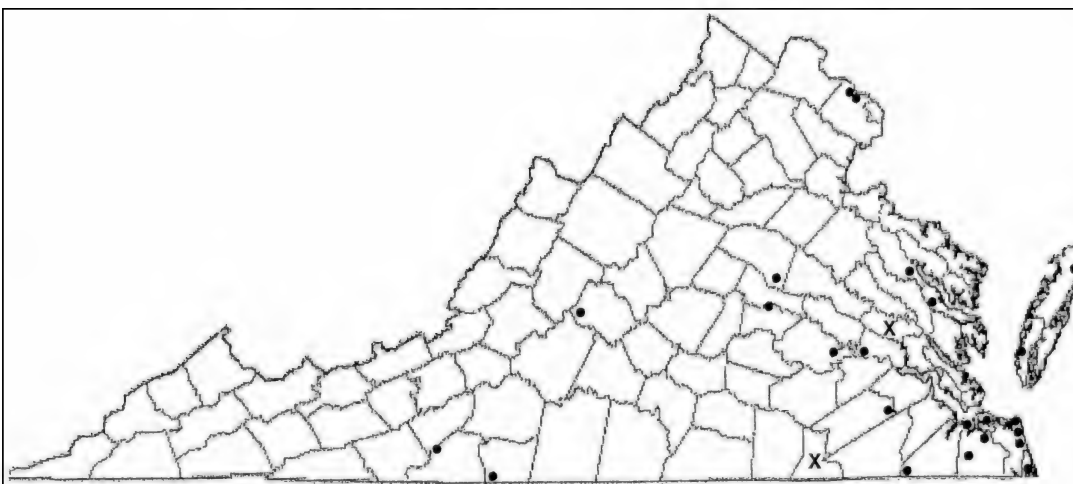


Fig. 50. Known distribution of *Chauliodes rastricornis* Rambur in Virginia.

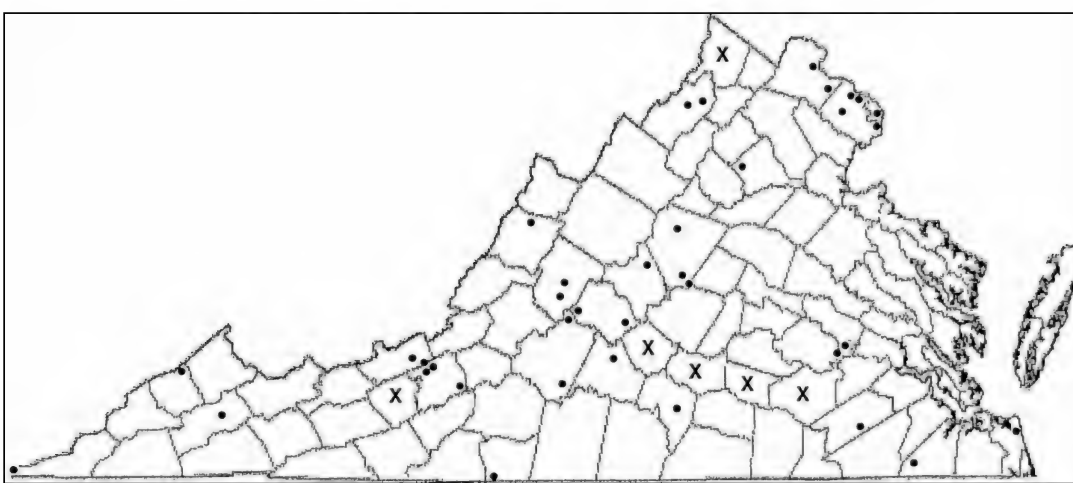


Fig. 51. Known distribution of *Corydalus cornutus* (Linnaeus) in Virginia.

*Nigronia fasciata* (Walker) Fig. 53

This species seems to be less frequently encountered than the following, and apparently inhabits the more upstream reaches of the habitat. It is known from AL to LA and north to MN and ME. In VA it is known from all regions, but uncommonly so in the Coastal Plain, and has been taken from mid-May to early July.

Alleghany, Bath, Bedford, Essex, Fairfax, Fauquier, Giles, Gloucester, Louisa, Montgomery, Patrick, Prince William, Roanoke, Rockbridge Co's.

*Nigronia serricornis* (Say) Fig. 54

Although often taken in company with the previous species, it is more common downstream. It is recorded from FL to KS and north to MN and ME, with a record from MB in Canada. This species is much more frequently collected and more widespread across the state, but has not been taken in the Coastal Plain. Collection dates in VA extend from early May to early July.

Albemarle, Amherst, Bath, Bedford, Clarke, Fairfax, Fauquier, Frederick, Giles, Highland, Loudoun, Louisa, Montgomery, Page, Prince William, Rappahannock, Rockbridge, Rockingham, Shenandoah, Smyth, Warren, Wythe Co's., Lexington, Richmond Cities.

## Family Sialidae

The family Sialidae, or alderflies, is relatively small, containing only eight extant (and four fossil genera, with one with both fossil and living species) genera and about 80 species. They are found in all the faunal realms, but are missing in most of Africa (only found in South Africa and Madagascar), and Indonesia and New Zealand (but found in Australia). Only three genera are recognized in the New World: *Ilyobius* with eight living species, *Protosialis* with three species, and *Sialis* with 22 species (Liu et al., 2015).

Genus *Protosialis* van der Weele

This is an exclusively American genus containing only three species: two from the USA (see below) and one, *P. bifasciata*, from Cuba. Although synonymized with *Sialis* by Ross (1937), *Protosialis* has also been recognized in recent years to include all the Neotropical and African Sialidae (Yang & Liu, 2010). I accept the most recent study of Liu et al. (2015).

*Protosialis americana* (Rambur) Fig. 55

This distinctive species is known from FL west to TX and north to WI and NH. In VA it seems to be limited to the Coastal Plain and adjacent Piedmont. It has been collected from late April to mid-August, with most collections in June.

Brunswick, Caroline, Charles City, Dinwiddie, Greenville, Henrico, King & Queen/Middlesex, Lancaster, Middlesex, Nottoway, Richmond, Sussex, Surry, York Co's., Chesapeake, Richmond, Suffolk, Virginia Beach Cities.

*Protosialis glabella* (Ross) \*\*\*

The discovery of this uncommon species in the state was a great surprise because it is far to the east of its other known sites. Its collector, Dr. Hoffman, made a special attempt in 2010 to obtain more examples at the locality where he took it in 1993, but was unsuccessful. The species was described from IL, and has since been recorded from KY and MS.

Halifax Co., Banister R. floodplain, Va. 716 bridge, ca. 3mi S Scottsburg, 16 Jun 1993, R.L. Hoffman, UV, 1♂, VMNH.

Genus *Sialis* Latreille

This is the largest genus in the family with over 50 species found throughout the Holarctic realm. All 22 New World species are found north of the Mexican/USA border but, surprisingly, none are known from south of this border (Whiting, 1991). Nine of the 14 eastern species have been taken in VA.

*Sialis aequalis* Banks Fig. 56

This species was described from Falls Church, VA and later recorded from Arlington and Vienna, VA (Ross, 1937). Its range is along the Atlantic coast from GA to ME, and west across the northern states to MN. The few VA specimens I have seen are from the northeastern part of the state. Whiting (1991) also lists it from Brunswick Co. and Suffolk City in the southeastern part of the state. The collection dates are from mid-April to early May.

Arlington, Fairfax Co's., Falls Church City.

*Sialis concava* Banks Fig. 57

This species seems to have a rather limited distribution from NC along the coastal states north to ON with a surprising record from BC. The VA records



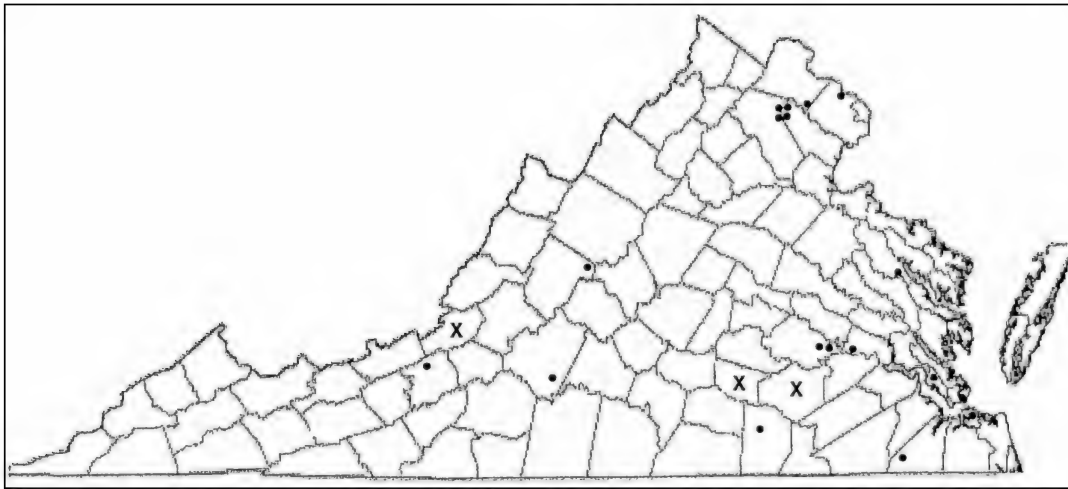


Fig. 52. Known distribution of *Neohermes concolor* (Davis) in Virginia.

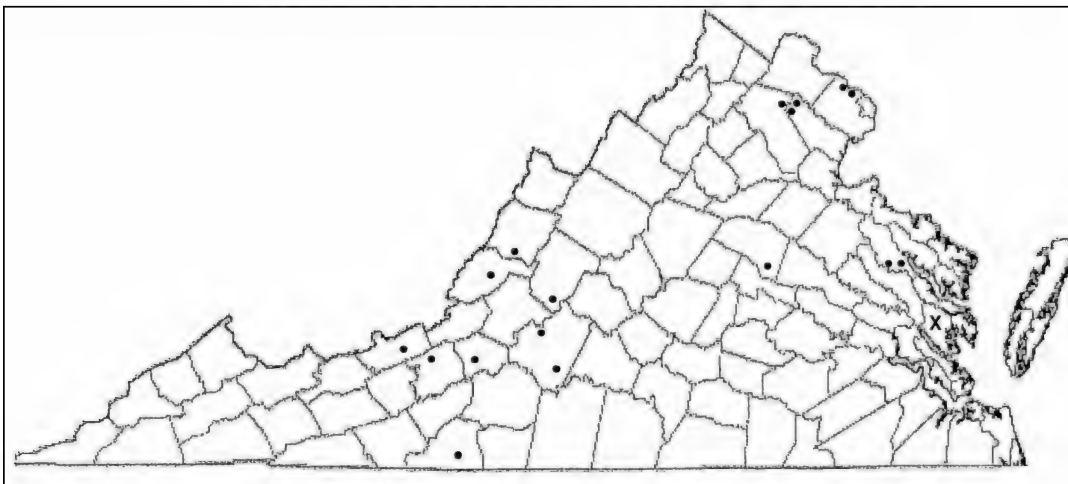


Fig. 53. Known distribution of *Nigronia fasciata* (Walker) in Virginia.

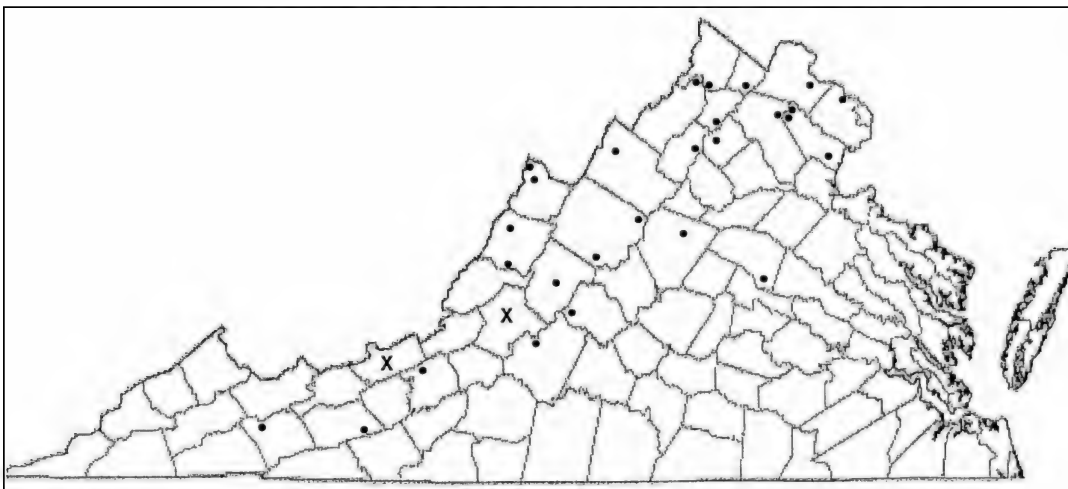


Fig. 54. Known distribution of *Nigronia serricornis* (Say) in Virginia.

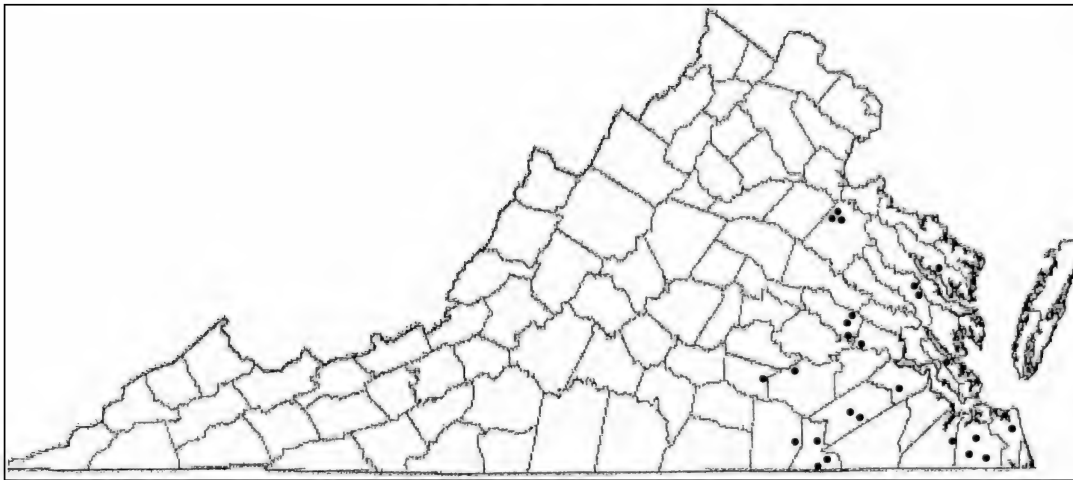


Fig. 55. Known distribution of *Protosialis americana* (Rambur) in Virginia.

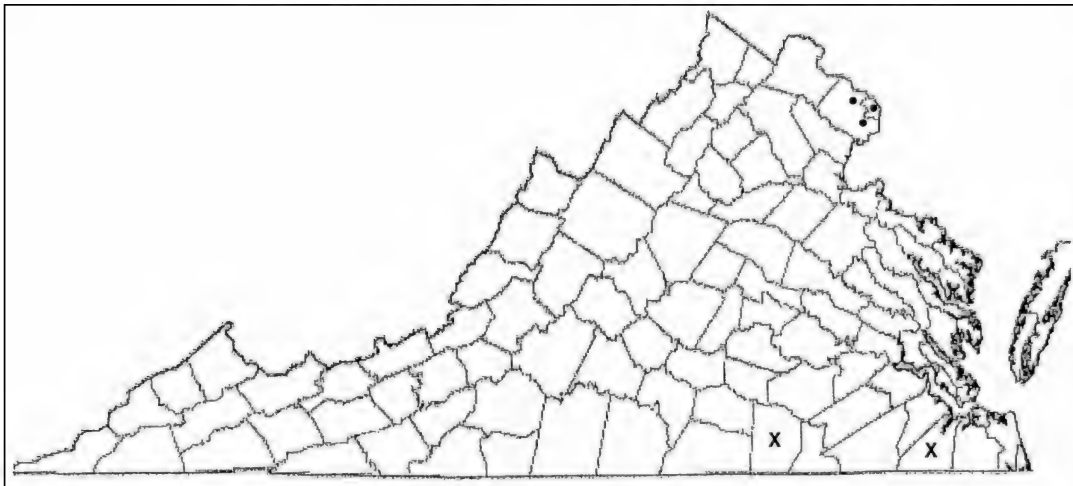


Fig. 56. Known distribution of *Sialis aequalis* Banks in Virginia.

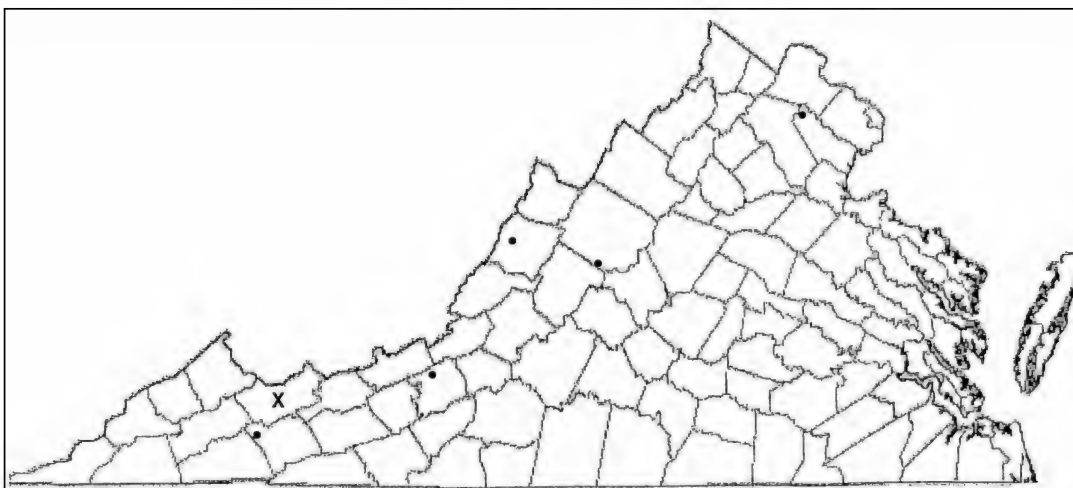


Fig. 57. Known distribution of *Sialis concava* Banks in Virginia.

are from the Alleghenies, west of the Blue Ridge, with several eastern records from the Bull Run Mountains in Prince William Co. Whiting (1991) also records the species from Tazewell Co. without specific data. The collection dates are from mid-April to mid-May.

Augusta, Bath, Montgomery, Prince William, Smyth Co's.

*Sialis contigua* Flint Fig. 58

This species was described from VA and has been recorded only from VA and TN, but there is a lot from PA in the NMNH. The species is mostly found west of the Blue Ridge throughout the Alleghenies. There is a record of the species, without details, from Shenandoah Co. (Whiting, 1991) and it has recently been taken in northern VA. It has been collected from late April to late May.

Bath, Craig, Giles, Highland (including holotype), Montgomery, Prince William, Smyth, Tazewell, Wythe Co's.

*Sialis infumata* Newman

This species has a rather wide range from SC to KS and north to MN and ON. Its type locality is listed as Trenton Falls, NJ by Ross (1937): this is an error, because the site is in NY where Doubleday collected in 1837. The few VA specimens I have seen are all from one short section of Broad Run, but Whiting (1991) also lists it from Rockingham Co.

Fauquier Co., Broad Run, Thorougfare Gap, 29 Apr 1962, O.S. Flint, Jr., 1♂, NMNH.

Prince William Co., Broad Run, Beverly Mill, 38°49.5' N, 77°42.6' W, 16 Apr-2 May 2013, D.R. Smith, Malaise Trap, 2♂, NMNH; same, but 18 Apr-5 May 2014, 3♂, NMNH.

*Sialis iola* Ross Fig. 59

The species has a wide distribution in the East: GA to MS and north to IN and QC. The records are widespread across VA, with Whiting (1991) adding Alleghany and York Co's. It has been collected from early April to late June.

Essex, Henrico, Louisa, Montgomery, Prince William, Smyth Co's.

*Sialis itasca* Ross Fig. 60

This is probably the most widespread eastern species of *Sialis*, being reported from GA to TX and north to ND and QC. The listed records below are in the

Piedmont and Shenandoah Valley, but Whiting (1991) also adds Augusta, Greene, and Rockingham Co's., perhaps extending its range farther into the Alleghenies. The material listed below was all taken in May.

Fairfax, Loudoun, Page Co's., Richmond City.

*Sialis joppa* Ross Fig. 61

This species is widespread east of the Mississippi River: FL to LA and north to WI and ON. It has been taken across VA, with the exception of the Coastal Plain. To the listed counties, Whiting (1991) adds Giles and Grayson Co's. It has been taken from early April (or possibly late March) to late May.

Fairfax, Fauquier, Louisa, Madison, Page, Prince William, Rappahannock, Rockingham, Smyth, Wythe Co's.

*Sialis vagans* Ross Fig. 62

This is another species widespread in eastern North America: FL to MS and KS north to MN and NS. In addition to the counties and cities listed below, Whiting (1991) adds Brunswick, Floyd, James City, Prince Edward, and Prince William Co's. The listed jurisdictions are in the Piedmont with one from the Dismal Swamp in the Coastal Plain. The VA collections range from early March to mid-May.

Culpeper, Fairfax, Goochland, Henrico, Loudoun, Louisa, Madison Co's., Chesapeake, Richmond Cities.

*Sialis velata* Ross Fig. 63

This is a widespread and transcontinental species in the North, being found in the USA from NC west to KS, CO, UT, and ID, and up the East coast to ME, and all across Canada from QC to BC. It is widespread in VA, but missing from the Coastal Plain. In addition to the listed localities, Whiting (1991) adds Page, Roanoke, Rockbridge, and Shenandoah Co's. It has been collected from early April into July.

Appomattox, Arlington, Culpeper, Fairfax, Giles, Goochland, Grayson, Loudoun, Montgomery, Prince William, Smyth, Wythe Co's., Radford, Richmond Cities.

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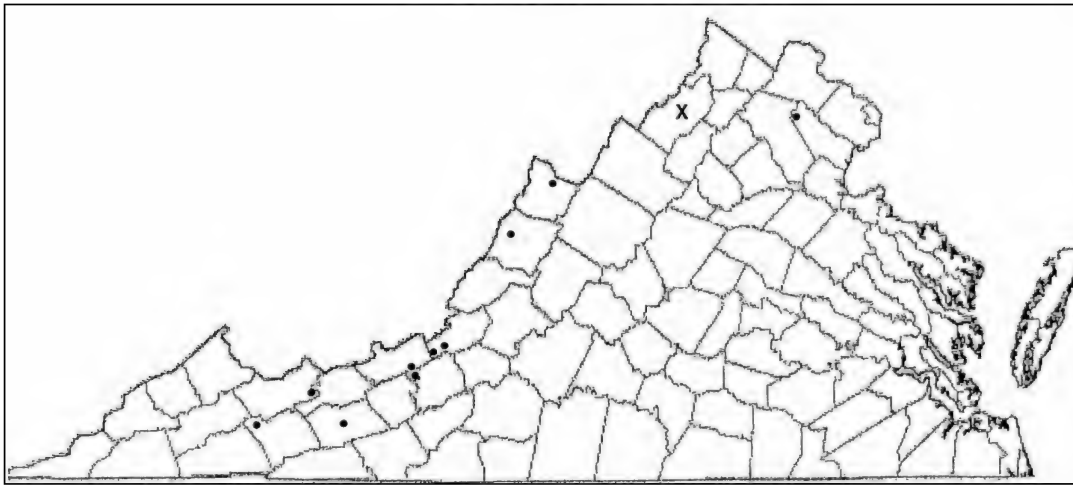


Fig. 58. Known distribution of *Sialis contigua* Flint in Virginia.

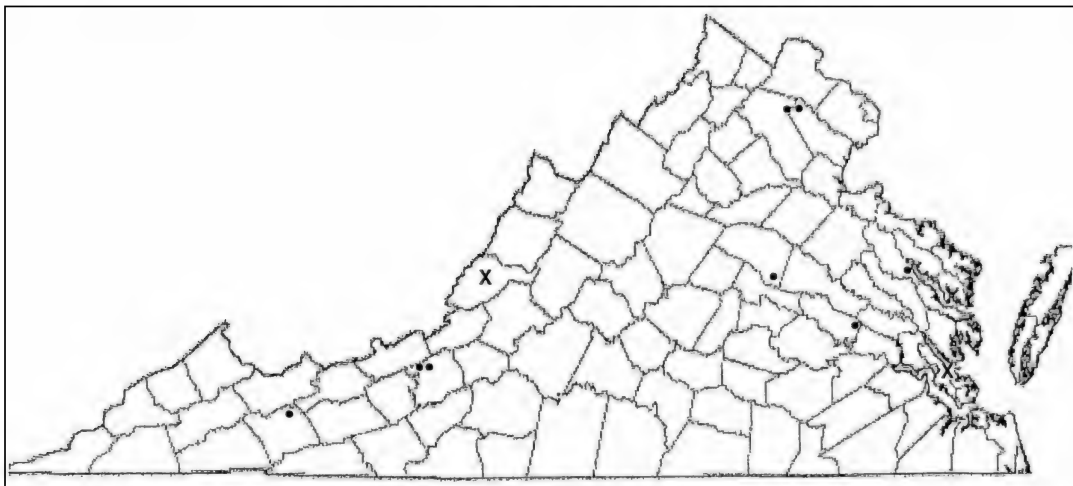


Fig. 59. Known distribution of *Sialis iola* Ross in Virginia.

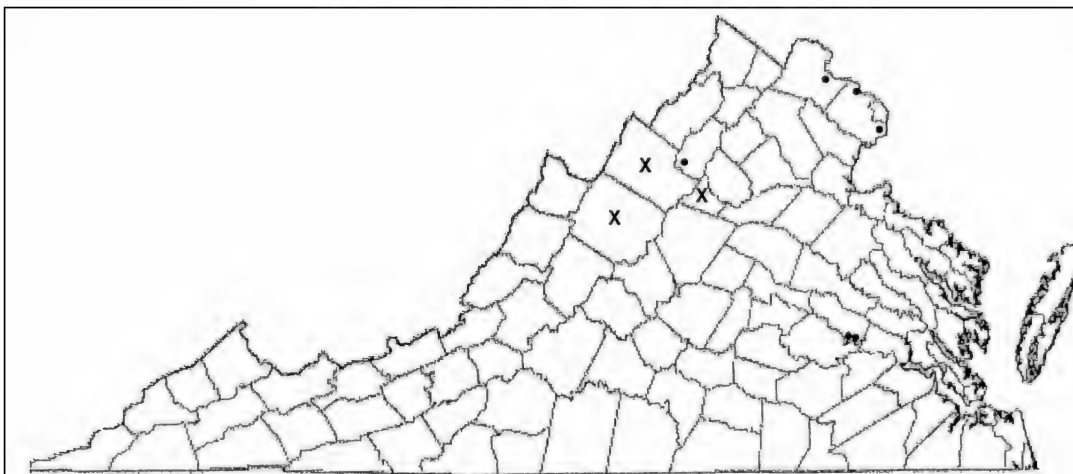


Fig. 60. Known distribution of *Sialis itasca* Ross in Virginia.



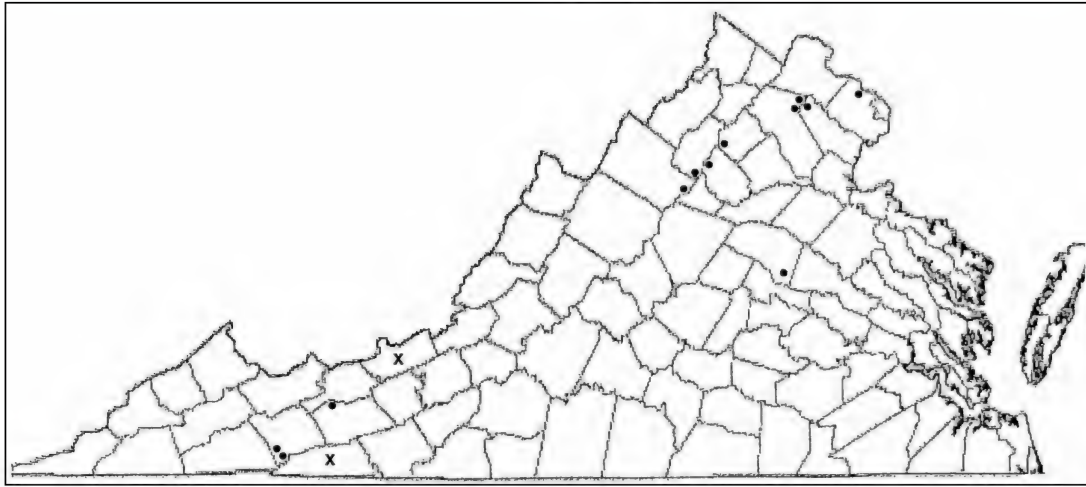


Fig. 61. Known distribution of *Sialis joppa* Ross in Virginia.

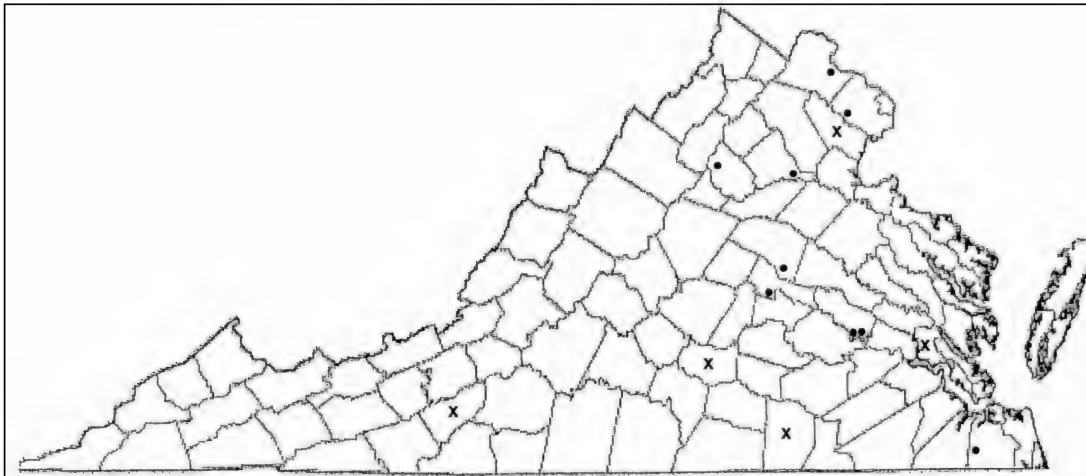


Fig. 62. Known distribution of *Sialis vagans* Ross in Virginia.

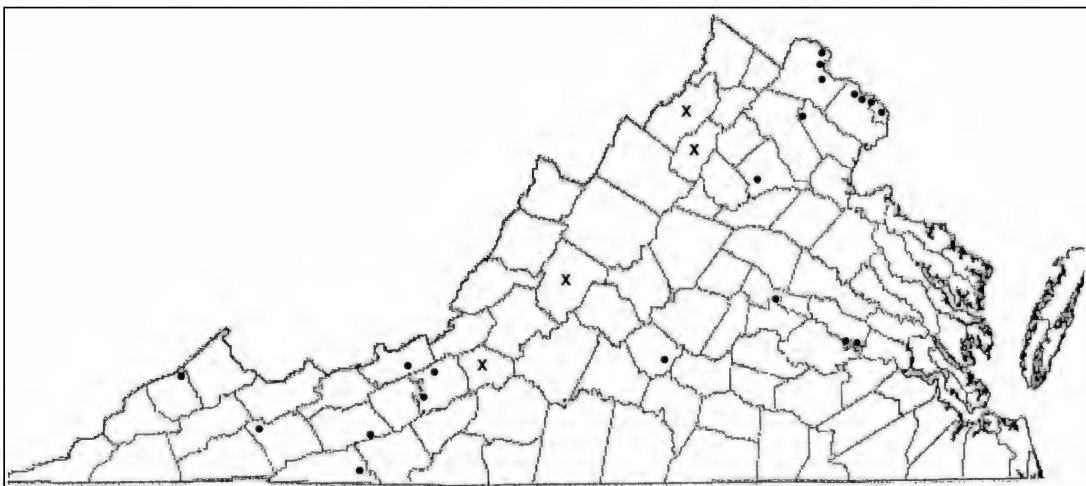


Fig. 63. Known distribution of *Sialis velata* Ross in Virginia.

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## Distribution of American Chestnut (*Castanea dentata*) in National Park Service Units of the National Capital Region

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### ABSTRACT

Once a dominant tree species of eastern U.S. forests, American chestnut (*Castanea dentata*) populations were devastated in the early 1900s by the introduction of an exotic fungal pathogen. The chestnut blight fungus (*Chryphonectria parasitica*) effectively eliminated the American chestnut as a canopy species throughout its native range, although it persists today as an understory species. Due to its ecological, economic, and cultural importance, various research approaches have been used to develop a blight-resistant chestnut, and after many decades of work, blight resistant trees may soon be available for restoration. Most of the National Park Service (NPS) units of the National Capital Region (NCR) fall within the native range of the American chestnut and may play a role in restoration efforts through research, interpretation, or demonstration plantings. Understanding the current distribution of American chestnuts in the NCR is the foundation for any of these actions. To this end, we inventoried trees in eleven park units in the summer of 2014 and described their frequency with respect to size, presence of blight, reproduction, and associated vegetation types. Most American chestnut trees in the NCR are small (mean dbh = 7.3 cm and mean height = 6.8 m) understory trees, and only a few exhibited signs of reproduction. Approximately 11% of the inventoried trees showed visual symptoms of blight. Chestnuts in the NCR were most frequently associated with U.S. National Vegetation Classification associations that are dominated by oaks (*Quercus* spp.) and ericaceous shrubs. We anticipate that these results will inform future inventory efforts and may provide guidance for the selection of reintroduction sites.

**Key words:** American chestnut, exotic species, forest vegetation, mid-Atlantic vegetation, restoration.

### INTRODUCTION

Prior to the introduction of an exotic pathogen in the early twentieth century, the American chestnut (*Castanea dentata* (Marshall) Borkh.) was a dominant tree species of eastern U.S. forests (Russell, 1987; Ellison et al., 2005). Its range extended from Mississippi to Maine (Little, 1977), and it comprised over 50% of the total basal area in some forest stands (Braun, 1950; Keever, 1953). Due to leaf tissue with allelopathic compounds and a relatively low C:N ratio, American chestnuts likely had a strong impact on forest composition and ecosystem functions, including decomposition, nutrient cycling, and productivity (Keever, 1953; Vandermast et al., 2002; Ellison et al.,

2005; Rhoades, 2007; Elliott & Swank, 2008). Its seeds were a valuable food resource for wildlife, domestic livestock, and humans (Anagnostakis, 1987; Paillet, 2002; Lutts, 2008), and the trees were an important economic resource for Southern Appalachian communities due to the high value of their lumber and seeds (Russell, 1987; Paillet, 2002).

In 1904, the chestnut blight fungus (*Chryphonectria parasitica*) was documented at the Bronx Zoological Park in New York (Anagnostakis, 1987; Jacobs, 2007). The pathogen was probably introduced on *Castanea* spp. seedlings imported from Asia, and it spread through eastern forests rapidly (~37 km/year). By 1950, trees within the entire native range of *C. dentata* were dead or dying (Anagnostakis, 1987). Symptoms of the chestnut blight include bark cankers, wilted foliage, epicormic sprouting below the cankers, and orange

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fungal stromata that appear on the bark (Anagnostakis, 1987). The fungus eventually girdles the infected tree, killing the cambium above the fungal mass, but it does not directly infect and kill the roots of the tree (Burke, 2011). Consequently, American chestnut persists today as re-sprouts originating from roots of trees or seedlings that established before the introduction of the blight (Stephenson et al., 1991; Paillet, 2002; Burke, 2011). These re-sprouts, however, rarely reach the forest canopy or reproductive status, and the species no longer plays an important ecological and economic role in Eastern forests.

Due to the ecological function and historical importance of the American chestnut, there has long been substantial interest in developing blight-resistant trees for reintroduction in eastern U.S. forests. Many approaches to mitigating the impacts of chestnut blight have been attempted, including developing hypovirulent strains of the blight to use as a biocontrol, intercrossing pure American chestnuts to promote natural blight resistance, using genetic engineering tools to create transgenic chestnuts, and developing a disease resistant hybrid of American and Asian chestnuts through backcross breeding (Diskin et al., 2006; Fei et al., 2007; Joesting et al., 2009; Jacobs et al., 2013; Newhouse et al., 2014). As a result of these efforts, blight-resistant trees may soon be ready for reintroduction (Jacobs, 2007; Dalglish & Swihart, 2012; Newhouse et al., 2014), and in the near future, there may be opportunities for public land managers in the eastern U.S. to support restoration efforts through research, demonstration, education, or restoration plantings on public lands (Lellis, 2006; Serald, 2011).

Understanding the current distribution and ecological status of naturally occurring American chestnuts can inform chestnut-related management actions in a number of ways (e.g., clarifying current and historical significance of chestnut to specific sites or regions, identifying habitats that are appropriate for chestnut reintroduction, informing surveys for flowering chestnuts to be included in breeding programs). To this end, we inventoried extant American chestnuts in National Park Service (NPS) units in the National Capital Region (NCR), in Washington, DC and nearby parts of Maryland, Virginia, and West Virginia. The objectives of this study were to: (1) create a database of living American chestnut that includes information related to the location, size, health, presence of blight symptoms, reproductive status, site conditions, and local habitat for each tree, (2) summarize the frequency of American chestnut trees with respect to height, diameter at breast height, incidence of blight, and reproduction, and (3) summarize U.S. National Vegetation Classification

(USNVC) associations (“vegetation types”) and habitat characters associated with inventoried trees. We expect that a better understanding of the current distribution and ecology of surviving trees will inform management decisions in the NCR National Parks and beyond.

## MATERIALS AND METHODS

### Study Area and Site Selection

We surveyed eleven NPS units in the NCR: Antietam National Battlefield, Catoctin Mountain Park, Chesapeake & Ohio Canal National Historical Park, George Washington Memorial Parkway, Harpers Ferry National Historical Park, Manassas National Battlefield Park, Monocacy National Battlefield, National Capital Parks - East, Prince William Forest Park, Rock Creek Park, and Wolf Trap National Park for the Performing Arts (Fig. 1). The NCR spans four physiographic provinces (from west to east these include: Ridge and Valley, Blue Ridge, Piedmont, and Coastal Plain) and a

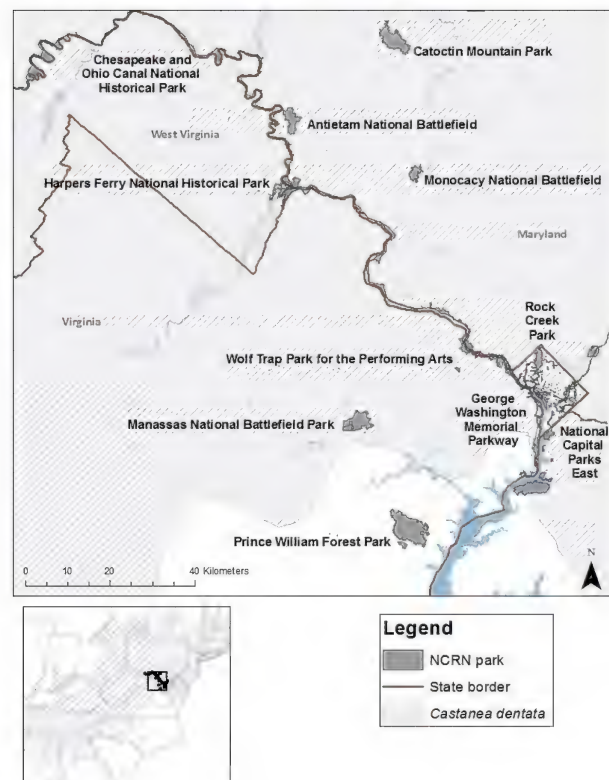


Fig. 1. Location of eleven National Capital Region (NCR) National Park Service units that were included in the American chestnut (*Castanea dentata*) survey. The hatched area is the species' approximate historical range (Little, 1977), and the inset identifies the NCR in the context of the entire historical range.

wide diversity of habitats, from alluvial forests and wetlands to upland oak-hickory forests.

Much of the NCR falls within the native range of the American chestnut, which spanned as far south as Mississippi and Alabama, west into Tennessee, and as far north as Maine and southern Ontario (Little, 1977; Tindall et al., 2004). Russell's (1987) summary of the pre-blight range and habitat affinity of the American chestnut found that the species was: present in the Piedmont and Blue Ridge of Virginia (although less common in the limestone valleys, Appalachian Plateau, or Coastal Plain), a dominant species in the Ridge and Valley and Blue Ridge of western Maryland, and common on hillsides in West Virginia. American chestnut was also reported in Coastal Plain forests of Anne Arundel, Calvert, Charles, and Prince George's counties in southern Maryland (Zon, 1904). Chestnuts were common across a wide elevational range in the mid-Atlantic region, and only a few habitats, including pure stands of hemlock and white oak, swamp forests, and forests on limestone-derived soils, were essentially devoid of chestnuts (Russell, 1987).

Survey sites were assembled from previous vegetation-related research in the NCR (e.g., Schmit et al., 2014) and personal observations of natural resource managers and local native plant enthusiasts (e.g., members of the Maryland Native Plant Society). We also targeted habitats known to be associated with American chestnuts, such as ridges and slopes with well-drained, acidic soils (Russell, 1987; Stephenson et al., 1991). Sites were surveyed during the growing season (May-October) in 2014. Trees were marked with stainless steel tags labeled with a unique identifying number, and Universal Transverse Mercator coordinates (NAD83) were recorded for each tree using a hand-held GPS. To document the surveyed areas, we recorded tracklines with the GPS unit and used ArcMap to create a 10 m buffer around these tracklines to estimate the total area searched.

#### Tree Characteristics

We measured diameter at breast height (dbh) of all stems  $\geq 1$  cm dbh and identified the crown class for each individual following the methods described in Schmit et al. (2014). Crown class refers to the position and height of the tree canopy compared to its neighbors and provides a relative measure of the amount of sunlight a tree receives. Crown classes include: open-grown, dominant, co-dominant, intermediate, overtopped, light gap exploiter, and edge tree. We recorded height using a ruler for trees  $< 2$  m and a laser range finder for trees  $\geq 2$  m.

American chestnuts have frequently been found to occur as stems sprouting from the stumps of old trees (Paillet, 2002). As such, we recorded the presence and diameter of stumps associated with living stems. We checked each individual for evidence of reproduction, including flowers (catkins), fruits (burs), seeds, or nearby seedlings. We visually inspected each tree for symptoms of the chestnut blight, including the presence of sunken or swollen cankers and orange stromata on the trunk. We compared mean dbh and mean height of reproductive versus non-reproductive trees and of blighted versus non-blighted trees with Student's *t*-tests. We also assessed each tree for conditions that might impact survivorship (e.g., presence of heart-rot, bark damage, buck rub, and beaver damage) and recorded the presence of re-sprouts at the base of a stem. As an indicator of White-tailed Deer (*Odocoileus virginianus*) browse pressure on chestnuts, we recorded whether stems were browsable (the maximum height of deer browse is approximately 1.5 m; Oswalt et al., 2006) and the presence of deer browse.

#### Site Characteristics

We recorded the slope and aspect of the immediate area around each tree. Following the completion of field sampling, we overlaid chestnut locations on NPS vegetation maps to extract the USNVC association mapped to each location (Jennings et al., 2009; Hazler et al., 2012) and identified the associations that were most commonly associated with extant American chestnuts. We then summarized the areal extent of these vegetation types in the NCR as a coarse estimate of the potential American chestnut habitat in the region. We extracted elevation values for each tree from a 3 m digital elevation model of the region and summarized the frequency of chestnut trees with respect to elevation.

### RESULTS

We found 234 living American chestnut trees in nine of eleven NPS units of the National Capital Region (all except Antietam National Battlefield and Manassas National Battlefield Park). Most of the NCR parks occur within the historical range of American chestnut (Fig. 1), but at least five trees found at Prince William Forest Park are outside of the range estimated by Little (1977). None of the inventoried trees was associated with an old stump. The majority were small trees, with dbh values ranging from 1.5 to 42.5 cm (mean = 7.3 cm) and heights ranging from 1.4 to 23.9 m (mean = 6.8 m) (Figs. 2a and 2b). Most were understory

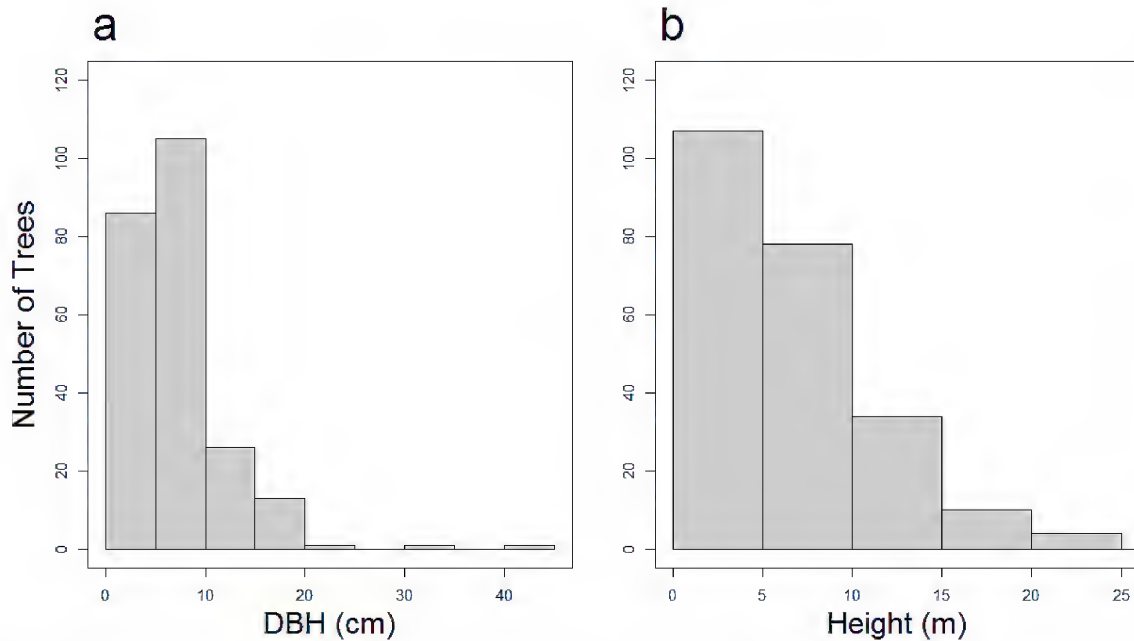


Fig. 2. Frequency of American chestnut trees with respect to (a) dbh and (b) height.

trees (91% of trees were classified as “overtopped” in the field), and only one tree reached the forest canopy (i.e., co-dominant crown class). Of the remaining trees, 5% were classified as light gap exploiters, 3% were classified as intermediate, and < 1% was classified as an edge tree. We found evidence of reproduction at seven trees, and these trees were larger than non-reproductive trees (dbh:  $t = -3.25$ ,  $df = 6.035$ ,  $p = 0.02$ , height:  $t = -2.78$ ,  $df = 6.23$ ,  $p = 0.03$ , Figs. 3a and 3c).

We found at least one visual symptom of chestnut blight fungus on 26 trees (11%), and similar to patterns of reproduction, blighted trees tended to be larger in terms of both dbh and height (dbh:  $t = -2.91$ ,  $df = 26.68$ ,  $p = 0.007$ , height:  $t = -1.85$ ,  $df = 30.17$ ,  $p = 0.07$ , Figs. 3b and 3d). About half of the sampled trees (54%) had re-sprouts growing from their base, which suggests many of them were responding to other stressors. The most commonly observed tree conditions (and number of trees on which they were observed) included: bark damage (99), large dead branches (90), advanced decay/heart-rot (35), primary branch broken (14), and buck rub (13). Of the 177 trees identified as browsable, 140 (80%) showed evidence of deer browse.

We found American chestnuts in a variety of topographic settings (Figs. 4 and 5), but they were most frequent on moderately sloped sites (mean = 24%) of W-NW and NE aspects and across a range of elevations (mean = 264 m). Chestnuts occurred in all four physiographic provinces (Valley and Ridge, Blue Ridge, Piedmont, and Coastal Plain) and were most

frequently found in vegetation types dominated by *Quercus* spp. (particularly *Q. montana* L.) and heath species (Ericaceae). American chestnuts were most commonly mapped to the following USNVC associations (with number of trees and USNVC's CEGL identification code): Central Appalachian/Northern Piedmont Chestnut Oak Forest (51, CEGL006299), Central Appalachian Basic Oak-Hickory Forest (46, CEGL008514), Central Appalachian Dry Chestnut Oak-Northern Red Oak/Heath Forest (42, CEGL008523), and Central Appalachian Dry-Mesic Chestnut Oak-Northern Red Oak Forest (40, CEGL006057). Other associations where more than ten American chestnut trees were found included: Mid-Atlantic Mesic Mixed Hardwood Forest (16, CEGL006075), Low-Elevation Mixed Oak/Heath Forest (11, CEGL008521), and Northern Piedmont Small-Stream Floodplain Forest (11, CEGL006492). The map units representing these vegetation types cover 6750 ha (> 30% of the total NCR area that has been classified to a USNVC vegetation type), suggesting that a substantial proportion of the NCR could be considered potential American chestnut habitat. We estimate that the total area covered by this survey was 450 ha.

## DISCUSSION

Despite decades of impacts due to chestnut blight, a substantial number of American chestnuts persist in the

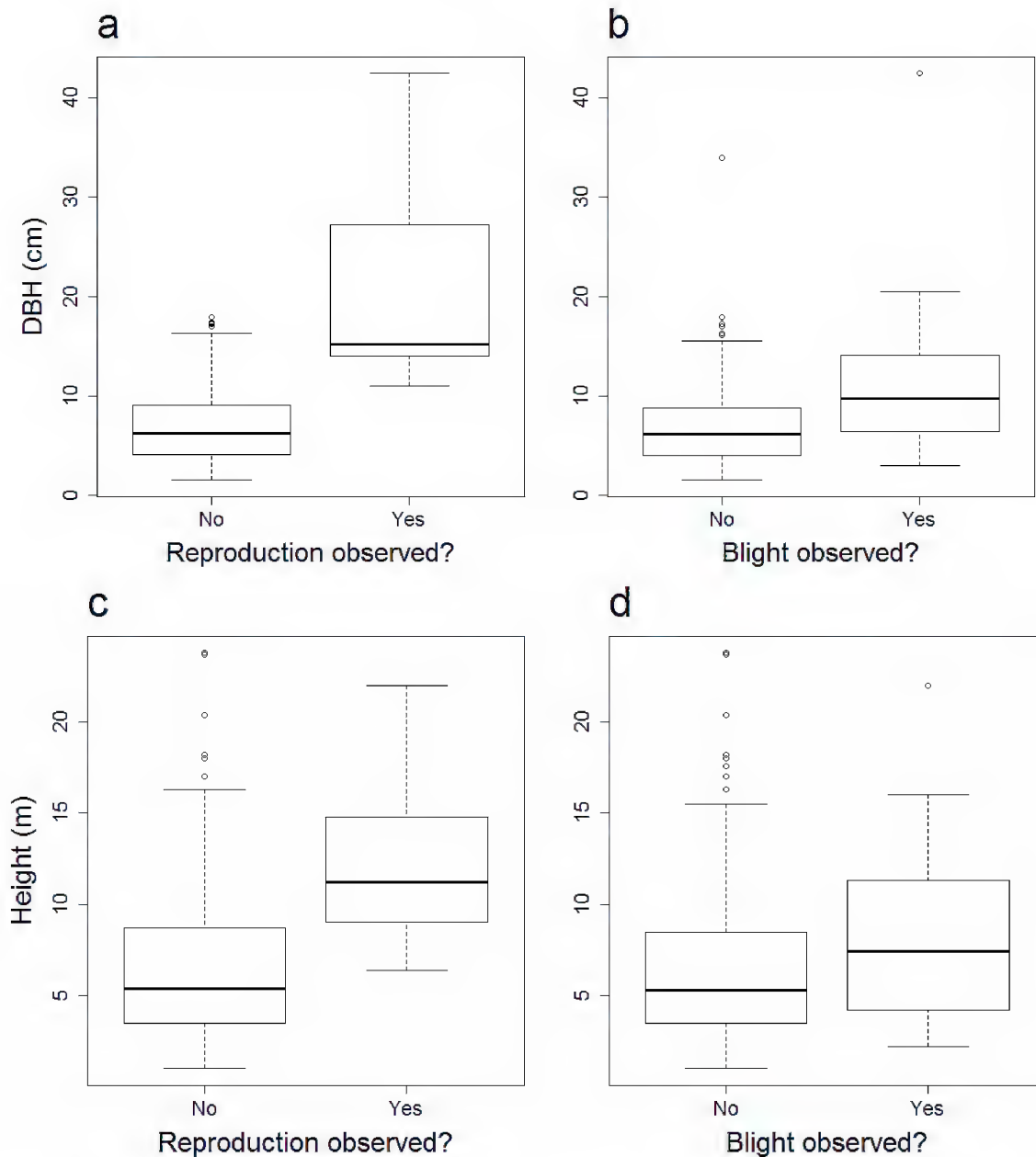


Fig. 3. The incidence of reproduction (flowers or fruits) and visual blight symptoms of American chestnut trees with respect to tree dbh (a and b) and height (c and d).

National Capital Region. Frequent re-sprouts of this species in forest understories have been documented elsewhere in the eastern U.S., although NCR trees were generally larger than those previously reported. An inventory of American chestnuts in upland forests of western Virginia, for example, found that most living stems did not exceed 2.5 cm dbh and that stems measuring > 6.3 cm dbh were uncommon (Stephenson

et al., 1991). Likewise, a study in Mammoth Cave National Park in Tennessee found that 86.9% of living American chestnuts had a dbh < 2.5 cm and only 0.7% exceeded 10 cm; in terms of height, 90.6% of the chestnut trees were < 3 m and only 2.1% were > 6 m (Fei et al., 2007). In contrast, many of the NCR chestnut trees were larger: 18% of NCR trees had a dbh > 10 cm and 44% were taller than 6 m (Fig. 2).



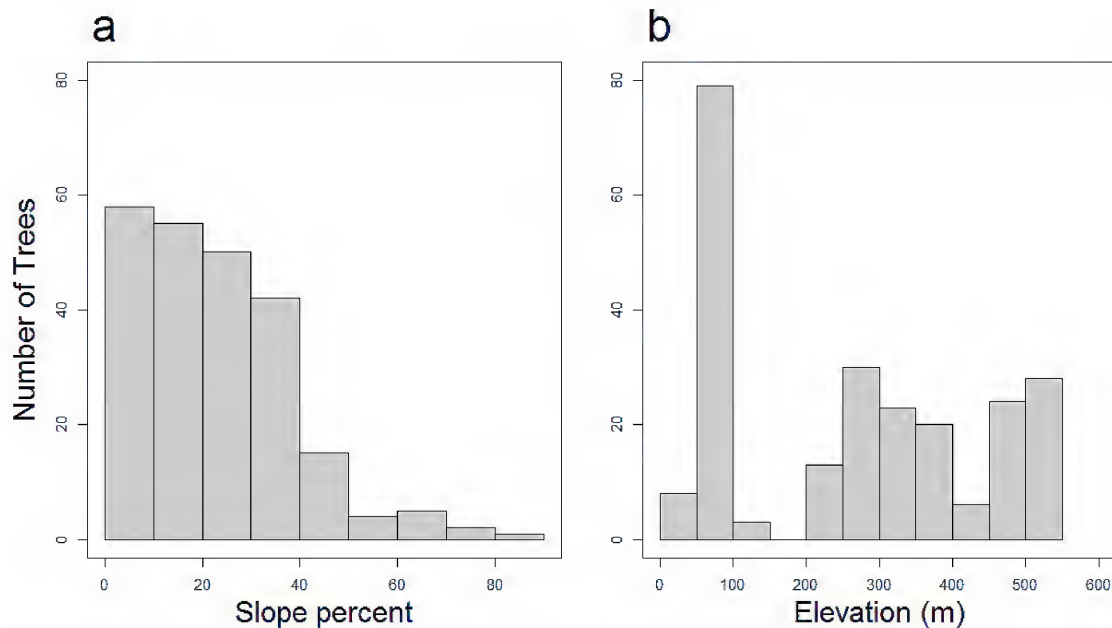


Fig. 4. Frequency of American chestnut trees with respect to (a) slope percent and (b) elevation.

Larger American chestnuts are more likely to be infected with the chestnut blight, which typically kills re-sprouts by the time they attain a height of 15 m and a dbh of 20 cm (Paillet, 2002). Indeed, NCR trees with visual symptoms of blight were larger than those without (Figs. 3b and 3d), but we also found relatively large trees that did not appear to be infected (e.g., 10 trees > 15 m tall had no visual symptoms of blight). Overall, visual symptoms of blight were uncommon among NCR chestnuts (11% displayed visual symptoms), although our estimate of blight infection may be conservative because some infected trees may not have had visual symptoms. Nevertheless, our estimate of blight frequency is well within those previously reported: southern Ontario – 30% (Tindall et al., 2004), Ridge and Valley province of Virginia – 15% (Burke, 2011), and Tennessee – 2% (Fei et al., 2007). We found no evidence of former, large tree stumps associated with the inventoried trees, which suggests that if these tree are re-sprouts, they may have originated from trees that were seedlings or saplings prior to the blight epidemic. Alternatively, stumps of the original trees may have rotted and no longer be detectable. Previous inventories in Virginia and New England found that few extant chestnuts were associated with former, large trees, and that little evidence remains of previous canopy trees in the form of logs or stumps (Paillet, 1988; Stephenson et al., 1991).

NCR chestnuts were found on hillsides of moderate

slopes, consistent with previously reported site descriptions (Russell, 1987; Fei et al., 2007), although they were associated with a wider range of aspects than previously reported. Chestnuts in the mountains of the Ridge and Valley province in Virginia, for example,

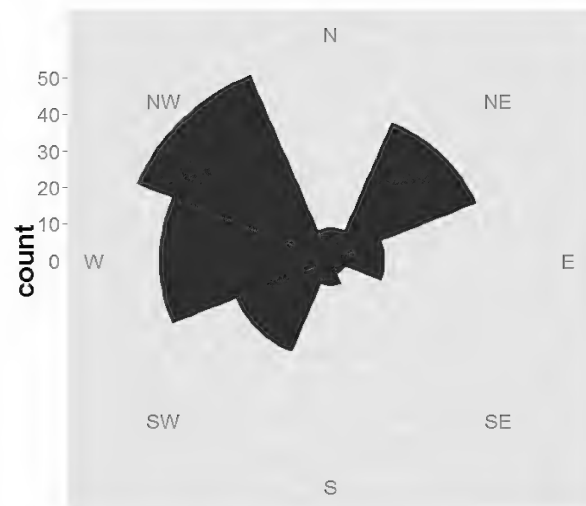


Fig. 5. Frequency of American chestnut trees with respect to aspect, summarized using a rose diagram. Each “pie piece” (or bin) represents 45 degrees. For example, the bin labeled “N” represents a total of 45 degrees or 22.5 degrees on either side of North (0 or 360 degrees). The radius of each “pie piece” equals the number of American chestnut trees found in each bin with each concentric ring equaling ten trees.



commonly occur on southern to western-facing slopes (Stephenson et al., 1991; Burke, 2012). We found a substantial number of individuals in similar sites, as well as on northeastern-facing slopes. NCR chestnuts were most commonly associated with vegetation types dominated by a mix of *Quercus* spp., including *Q. montana* (chestnut oak), *Q. rubra* L. (northern red oak), and *Q. alba* L. (white oak), and shrubs in the heath family (Ericaceae), including *Kalmia latifolia* L. (mountain laurel), *Vaccinium* spp. (blueberries), and *Gaylussacia* spp. (huckleberries). The frequent co-occurrence of American chestnut and ericaceous shrubs is well-supported (Russell, 1987; Stephenson et al., 1991). We found *K. latifolia* was a particularly good indicator of potential chestnut habitat in the field, likely reflecting its association with acidic soils (Russell, 1987). The apparent absence of chestnut at Antietam National Battlefield is likely due to the limestone-derived soils that dominate this park, consistent with previous inventories showing American chestnut is mostly absent from these soils (Russell, 1987; Tindall et al., 2004).

Although American chestnuts were the focus of this inventory, we also encountered many Allegheny chinkapins (*C. pumila* (L.) P. Miller), the only other *Castanea* species native to North America, as well as exotic species Chinese chestnuts (*C. mollissima* Blume) and Japanese chestnuts (*C. crenata* Siebold & Zucc.). These exotic individuals might be associated with old homesteads or might be the escaped progeny of planted trees in developed areas. Some of these exotic species were present in the natural areas where we found *C. dentata* re-sprouts, suggesting that there is some potential for hybridization among *Castanea* species in the region.

#### Implications for Restoration

We expect this inventory will inform American chestnut management and restoration activities in the mid-Atlantic region. Some of the approaches used to develop blight-resistant plant material for restoration (e.g., breeding programs) will need to use as many unrelated *C. dentata* individuals at each generation as possible to effectively sample native genetic diversity. Furthermore, the use of parent trees from the region where progeny are to be planted will be important for promoting local adaptation (Jacobs et al., 2013). Given that we searched approximately 7% of likely chestnut habitat (i.e., 450 ha of 6750 ha mapped to associated USNVC vegetation types), there are likely to be many more naturally occurring chestnuts in the NCR than we documented. All of the NPS units in the NCR have vegetation maps that include USNVC associations

wherever possible. To maximize efficiency and success of efforts to find reproductive trees, future inventory work might focus on the vegetation types identified in this paper.

Despite promising developments in the pursuit of American chestnut restoration, many challenges remain on the path to success. First, not all approaches to developing blight-resistant chestnuts are equally accepted by the restoration community. Breeding programs that hybridize American and Asian chestnuts to confer blight-resistance to the American chestnut, for example, are considered controversial and biologically risky by some, since this approach would require introducing genes from a non-native species into natural habitats. Potential consequences include transfer of non-native genes to sexually compatible native trees, which might confer a competitive advantage and result in invasive behavior, or unanticipated impacts to native organisms that interact with the hybrid trees. Second, deer browse is a major stressor of eastern deciduous forests and frequently limits forest regeneration (Russell, 2001; McShea, 2012). Approximately 80% of browsable chestnuts in this study were browsed. In contrast, only 27% of the browsable saplings (woody plants with dbh  $\geq 1$  cm and  $< 10$  cm) occurring in  $> 400$  permanent vegetation plots in the NCR parks were browsed during the last surveys of these plots (Schmit et al., 2014). Test plantings of American chestnuts in national forests have also identified deer browse as a major challenge for restoration efforts (Clark et al., 2014). Finally, many large-scale ecological changes over the last century (e.g., introduction of exotic pests and pathogens, fire suppression, climate change) may not be favorable to chestnut reintroduction (Jacobs et al., 2013; Clark et al., 2014). Further field-testing of blight-resistant trees will be needed to develop strategies to mitigate these challenges (Jacobs et al., 2013).

#### SUMMARY

The American chestnut is still frequently encountered as an understory tree in the forests of the mid-Atlantic region, and as long as the root systems of these trees persist, there is no immediate threat of extinction. We expect this inventory will inform decisions about whether and how to proceed with demonstration plantings or restoration activities (e.g., selecting appropriate sites for plantings) and will guide continued efforts to survey for surviving trees and for the elusive blight-resistant individual which could substantially improve the speed and efficacy of breeding programs.

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## Noteworthy Plant Records from Fort A. P. Hill, Caroline County, Virginia

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### ABSTRACT

Since 2013, 14 new discrete locations of state- and/or federally-listed vascular plants have been documented on Fort A. P. Hill, Virginia, including seven new sites of *Helonias bullata*, six of *Juncus caesariensis*, and one of *Panax quinquefolius*. Geographic Information Systems (GIS) data were used to effectively predict habitat for the protected wetland species *Helonias bullata* and *Juncus caesariensis*. In 2014, 16 new vascular plant records were documented for Caroline County, Virginia, eight of which were non-native and/or invasive species; *Liparis loeselii* was the rarest of the 16 new records.

**Key words:** Fort A. P. Hill, *Helonias bullata*, *Juncus caesariensis*, *Panax quinquefolius*, county records, Caroline County, Virginia, *Liparis loeselii*.

### INTRODUCTION

U.S. Army Garrison, Fort A. P. Hill occupies 30,673 ha of the inner Coastal Plain within Caroline (99.8%) and Essex (0.2%) counties, Virginia. The installation is approximately 65 km west of the Chesapeake Bay between the Rappahannock and Mattaponi Rivers (Fig. 1) (Fort A. P. Hill, 2008). In accordance with the Endangered Species Act, the Sikes

Act, and Fort A. P. Hill's Integrated Natural Resources Management Plan, Fort A. P. Hill manages threatened and endangered species to ensure no net loss in military readiness and to provide a conservation benefit to listed species. Fort A. P. Hill's Directorate of Public Works, Environmental & Natural Resources Division (ENRD) monitors the populations and habitat of listed species while also extending conservation and management considerations to all natural resources within its jurisdiction (Fort A. P. Hill, 2008).

Fort A. P. Hill harbors two federally-threatened, state-endangered plant species, *Helonias bullata* (belonging to a monotypic genus, hereafter referred to as *Helonias*) and *Isotria medeoloides*, and two state-threatened species, *Juncus caesariensis* and *Panax quinquefolius* (Townsend, 2014).

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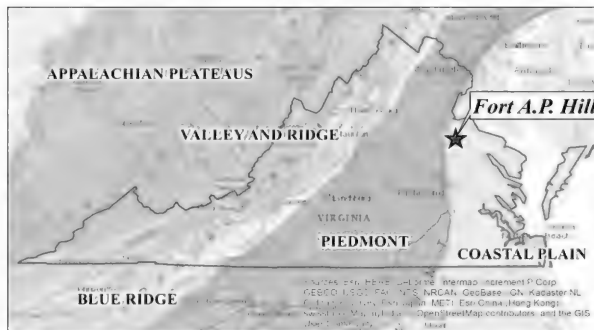


Fig. 1. Location of Fort A.P. Hill in the context of regional physiographic provinces; map by Fort A.P. Hill, ENRD.

### NEW PROTECTED SPECIES OCCURRENCES

ENRD reviews all Fort A. P. Hill projects for potential impacts to protected species, and typically field reconnaissance (i.e., a search for plants) is conducted before ground-disturbing activities (e.g., timber harvests, construction, etc.). To assist in this process, ENRD developed two GIS models to improve the efficacy of their surveys for the two listed wetland species. Prior to the 2013 field season, *Helonias* was documented at Fort A. P. Hill at 47 discrete sites. Principal habitat includes acidic sandy swamps, bogs, seeps, drainages, and small streamsides which do not receive prolonged periods of inundation (Sutter, 1984; Laidig et al., 2009; Punsalan, 2014; Floyd et al., 2015). To predict *Helonias* habitat, wetlands were assigned a habitat probability score based on the presence and spatial extents of three criteria: (1) proximity to known *Helonias* locations, (2) palustrine forested wetlands, and (3) acidic seepage swamps. The United States National Vegetation Classification (USNVC) was used to identify acidic seepage swamps (Hazler & Taverna, 2012), and spatial data for the first two criteria were provided by subject matter experts at Fort A. P. Hill. To validate this methodology, ENRD reconnoitered 212 ha of predicted *Helonias* habitat; 173 ha (82%) were found to be either ideal *Helonias* habitat (i.e., acidic wetland seepages) or at least a mosaic of *Helonias* habitat mixed with other wetland types, and initially two new *Helonias* sites were discovered through the course of model validation (Floyd et al., 2015). Through a combination of field reconnaissance and model validation, ENRD has discovered a total of seven new *Helonias* locations since 2013.

*Juncus caesariensis*, was previously documented at nine sites on Fort A. P. Hill. Across its range, *J. caesariensis* is associated with groundwater seepage as its defining habitat feature (Wieboldt, 2000). This

species is generally restricted to acidic, saturated soil with overlaying layers of Sphagnum and open sunlight (Strong & Sheridan, 1991). Sites at Fort A. P. Hill are typically found in inundated, and occasionally submerged, acidic soils (Wieboldt, 2000). *Juncus caesariensis* may possess some degree of dependence on disturbance to remove secondary woody succession (Strong & Sheridan, 1991), and at Fort A. P. Hill, this species is often found at sites that receive intermittent beaver-facilitated flood events that likely function as necessary disturbance. Using GIS spatial data, ENRD identified that known *J. caesariensis* sites were often located adjacent to a non-standard USNVC map unit identified as “semi-permanent impoundments” (e.g., beaver ponds) (Hazler & Taverna, 2012). To validate this observation, ENRD identified and reconnoitered 134 ha of wetlands adjacent to other “semi-permanent impoundments” within the same watersheds as known *J. caesariensis* sites. The result was the initial discovery of three new locations with *J. caesariensis* during the validation of the model (Floyd et al., 2015). Three additional sites (six in total) harboring *J. caesariensis* have since been discovered within the wetlands of Fort A. P. Hill.

One new *Panax quinquefolius* occurrence was also found while conducting field reconnaissance near Mount Creek. One individual was found growing in a mature hardwood forest along a generally east-facing slope characterized primarily by various species of *Quercus* spp. *Carya* spp., and *Fagus grandifolia*.

### NEW COUNTY RECORDS

While conducting habitat assessments and various surveys of the protected species of Fort A. P. Hill, ENRD began collecting voucher specimens of plant species that were not recorded in the installation's herbarium records. Concurrently, using the flora list provided by the Digital Atlas of the Virginia Flora (Virginia Botanical Associates, 2014), ENRD also collected voucher specimens as contributions to the flora of Caroline County. From April to September 2014, 16 new distributional records were verified for the county (Table 1). All voucher specimens were deposited at the Massey Herbarium (VPI).

Among the new county records, *Liparis loeselii* (Fig. 2), a Virginia G5/S2 rare plant species (Townsend, 2014), was recorded from one site along an old earthen berm under forest canopy. This habitat description is contrary to typical descriptions of this species' habitat, which is more often characterized by fens and wet grassy areas open to sunlight (Bentley, 2000; Weakley et al., 2012). However, there are



Table 1. Noteworthy plant records from Fort A. P. Hill.

New Records for Caroline County, Virginia		
Scientific Name*	Family	Common Name
<i>Berberis bealei</i>	Berberidaceae	Leatherleaf Mahonia
<i>Conoclinium coelestinum</i>	Asteraceae	Mistflower
<i>Dipsacus fullonum</i>	Caprifoliaceae	Common Teasel
<i>Hypericum perforatum</i>	Hypericaceae	Common St. John's-wort
<i>Iris domestica</i>	Iridaceae	Blackberry-lily
<i>Lespedeza bicolor</i>	Fabaceae	Shrubby Bush- clover
<i>Liparis loeselii</i>	Orchidaceae	Bog Twayblade
<i>Nyssa biflora</i>	Nyssaceae	Swamp Tupelo
<i>Passiflora incarnata</i>	Passifloraceae	Purple Passionflower
<i>Passiflora lutea</i>	Passifloraceae	Yellow Passionflower
<i>Pueraria montana</i> var. <i>lobata</i>	Fabaceae	Kudzu
<i>Pyrus calleryana</i>	Rosaceae	Bradford Pear
<i>Rubus phoenicolasius</i>	Rosaceae	Wineberry
<i>Senna marilandica</i>	Fabaceae	Southern Wild Senna
<i>Silene stellata</i>	Caryophyllaceae	Starry Campion
<i>Vitis cinerea</i> var. <i>floridana</i>	Vitaceae	Florida Grape
New occurrences of federally and state listed Species		
<i>Helonias bullata</i>	Heloniadaceae	Swamp Pink
<i>Juncus caesariensis</i>	Juncaceae	New Jersey Rush
<i>Panax quinquefolius</i>	Araliaceae	American Ginseng

\*Taxonomy follows Weakley et al. (2012).

accounts of *L. loeselii* growing in drier environments, often in early successional forests (McMaster, 2001). Based on 1943 aerial photography of Fort A. P. Hill, this site is believed to have once been the downhill edge of an agricultural field, which has since become a successional transition zone between a pine forest (*Pinus taeda* and *Pinus virginiana*) and a mature hardwood forest with greater diversity. The herb layer along the berm was characterized by a high diversity of orchid species including *Aplectrum hyemale*, *Corallorhiza odontorhiza*, *Cypripedium acaule*, *Goodyera pubescens*, *Liparis liliifolia*, and *Malaxis unifolia*. *Liparis liliifolia* was equally as abundant as *L. loeselii* in the immediate area, but the two species were easily distinguished by flowering individuals. The discovery of *L. loeselii* at Fort A. P. Hill adds to the



Fig. 2. *Liparis loeselii*, photo by Fort A. P. Hill, ENRD.

already rich orchid diversity known to exist on the installation.

Two of the new distributional records represent a northward extension of the known range within Virginia. *Vitis cinerea* var. *floridana*, a Coastal Plain taxon, was previously recorded in Virginia only as far north as King and Queen County; this species has also been recorded from Maryland (Maryland Biodiversity Project, 2015). Many previous Virginia records of this species are not identified to the level of variety, making the relative distribution of the two forms within the state uncertain (Virginia Botanical Associates, 2014). Similarly, the northward range limit of *Nyssa biflora* was not well documented because this taxon was previously included within *Nyssa sylvatica*. Both species of *Nyssa* are found throughout Fort A. P. Hill, but *N. biflora* was recorded as a separate species for Caroline County for the first time by ENRD in 2014.

Four county records are recognized invasive alien plant species in the Commonwealth of Virginia (Heffernan, 2014): *Dipsacus fullonum*, *Lespedeza bicolor*, *Pueraria montana* var. *lobata*, and *Rubus phoenicolasius*. Each of these records was fully naturalized in the environments in which they were recorded. In addition to the invasive species, four additional non-native species were collected as new records for Caroline County: *Berberis bealei*, *Iris domestica*, *Hypericum perforatum*, and *Pyrus calleryana*. *Iris domestica* and *Hypericum perforatum* are likely to have escaped from plantings from historic home sites predating the Army's acquisition of the land in 1939 based on the proximity of the collection site to these cultural sites. The origin of the other non-native and invasive species cannot be definitively identified.

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## Shorter Contributions

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NOTEWORTHY BEETLE RECORDS FROM  
VIRGINIA AND MARYLAND (COLEOPTERA:  
ANTHICIDAE, BUPRESTIDAE, CARABIDAE)

## VIRGINIA

## Carabidae

*Loxandrus erraticus* (Dejean) – Fairfax Co.: Great Falls Park, 18 May and 1 and 8 June 2015, Steury (George Washington Memorial Parkway [GWMP], 3). **NEW STATE RECORD.**

This black, iridescent ground beetle was collected in deep, wet, mud-caked leaf litter with small, waterlogged woody debris along the edge of a large, shaded, vernal pool and at a small dry vernal pool with moist leaf litter. The species ranges along the Coastal Plain from Rhode Island and Connecticut to central Florida, west to southern Louisiana and north along the Mississippi River drainage to east-central Illinois (Bousquet, 2012). It has been documented from North Carolina and Pennsylvania, so it was expected in Virginia. *Loxandrus erraticus* is distinguished from several very similar species by the following combination of characters: Metepisternum punctate; mentum with pair of indistinct foveae; pronotum with lateral margin slightly sinuate before acute hind angle; pronotal disc without microsculpture; body length 9.2 – 10.2 mm and width of pronotum  $\leq 3.3$  mm. This record increases the number of geadephagan beetles documented from the Potomac River Gorge to 257 species and the number from Virginia to 544 species. Associated carabid species present at the vernal pool on 18 May included *Bembidion affine* Say, *Carabus vinctus* (Weber), *Chlaenius aestivus* Say, *Clivina americana* Dejean, *Loxandrus brevicollis* (LeConte), *Olisthopus parmatum* (Say), *Oodes amaroides* Dejean, and *Tachys potomaca* (Erwin).

In addition to the *L. erraticus* record cited above, the following seven carabid beetles are first records for the national park GWMP, thus increasing the number of geadephagan beetles known from the park to 193 species (192 carabids and one rhysodid: Steury et al., 2014; Steury & Messer, 2014). All specimens are from Fairfax County, Virginia, except for *Chlaenius lithophilus* Say, and three of the five specimens of *Bembidion semistriatum* (Haldeman), which were collected in the District of Columbia.

*Bembidion semistriatum* (Haldeman) – Great Falls Park, 8 June 2015, Steury (GWMP, 2), gravel bar along small stream at edge of deciduous woods. Theodore Roosevelt Island, 9 July 2015, Steury (GWMP, 3), tidal shore with sand and gravel.

*Chlaenius lithophilus* Say – Theodore Roosevelt Island, 9 July 2015, Steury (GWMP, 1), sandy tidal shore of Potomac River under driftwood.

*Dicaelus purpuratus purpuratus* Bonelli – Great Falls Park, 1 June 2015, Steury (GWMP, 1), under leaf litter at edge of Great Falls Swamp.

*Loxandrus velocipes* Casey – Great Falls Park, 14 May 2015, Steury (GWMP, 1), wet, muddy leaf litter with waterlogged woody debris along the edge of a large, shaded vernal pool.

*Olisthopus parmatum* (Say) – Great Falls Park, 18 May 2015, Steury (GWMP, 1), moist, mud-caked leaf litter with small waterlogged woody debris 1.5 m from the edge of a large, shaded vernal pool.

*Omophron labiatum* (Fabricius) – Riverside Park, 10 June 2015, Steury (GWMP, 1), splashed from tree rootlets along tidal gravel shore at mouth of Little Hunting Creek.

*Pterostichus corvinus* (Dejean) – Great Falls Park, 1 June 2015, Steury (GWMP, 1), muddy bank of a stream in Great Falls Swamp.

## Buprestidae

*Texania campestris* (Say) – Fairfax Co.: Great Falls Park, 17 April 2013, Steury (GWMP, 1). **NEW STATE RECORD.**

This infrequently to rarely collected jewel beetle (Paiero et al., 2012) was found on the floor of a mature tulip poplar/oak/hickory woodland near the center of the park. Reaching lengths of up to 30 mm, it is the second largest buprestid species known from Virginia. It has been documented from Florida to New York, but has not been found in South Carolina or north of Long Island along the Atlantic Coast (Paiero et al., 2012; Harpootlian & Bellamy, 2014).

In addition to *T. campestris*, the following two buprestid beetles are first records for the national park GWMP, thus increasing the park's fauna to 26 species (Steury et al., 2012).

*Agrilus egenus* Gory – Fairfax Co.: Great Falls Park, 23 May - 5 June 2008, Steury & Smith (GWMP, 1♂), malaise trap set near Sandy Landing. The host plant of this beetle is black locust (*Robinia pseudoacacia* L.).

*Agrilus planipennis* Gory – Fairfax Co.: Great Falls Park, 20 May 2014, Steury (GWMP, 1♀), found dead on sidewalk near visitor center. This non-native buprestid, commonly known as the emerald ash borer, was first detected in GWMP in 2014 and since then has killed at least 1,000 ash trees (*Fraxinus*) within the park.

## MARYLAND

### Anthicidae

*Malporus properus* Casey – Calvert Co.: Cove Point, 15 June 2012, Steury (NMNH, 1).

This ant-like flower beetle was collected under driftwood on a sand dune between the Chesapeake Bay and a freshwater marsh. It was fairly commonly collected along the Eastern seaboard until the early 1900s, but there is only one other record of it from east of the Appalachian Mountains (Cecil County, Maryland, 1978) in the last 70 years (Chandler, 1997).

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Chandler, D. S. 1997. Revision of the genus *Malporus* Casey (Coleoptera: Anthicidae: Anthicinae). Coleopterists Bulletin 51: 265-275.

Harpootlian, P. J. & C. L. Bellamy. 2014. Jewel Beetles (Coleoptera: Buprestidae) of South Carolina. Biota of South Carolina. Volume 7. Clemson University, Clemson, SC. 127 pp.

Paiero, S. M., M. D. Jackson, A. Jewiss-Gaines, T. Kimoto, B. D. Gill & S. A. Marshall. 2012. Field Guide to the Jewel Beetles (Coleoptera: Buprestidae) of Northeastern North America. University of Guelph, Guelph, Ontario, Canada. 411 pp.

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Steury, B. W. & P. W. Messer. 2014. Twelve ground beetles new to Virginia or the District of Columbia and an annotated checklist of the Geadephaga (Coleoptera, Adephaga) from the George Washington Memorial Parkway. Banisteria 43: 40-55.

Steury, B. W., P. W. Messer, & J. F. Cavey. 2014. Noteworthy beetle records from Virginia, Maryland, and the District of Columbia (Coleoptera: Carabidae and Chrysomelidae). Banisteria 44: 23-25.

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## Miscellanea

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## Obituary

David W. Johnston (1926-2015)



David Ware Johnston of Fairfax, a longtime member of the Virginia Natural History Society (joined in 1994), died on 26 July 2015 at the age of 88 due to advanced prostate cancer. He was born on 23 November 1926 in Miami, the youngest of four boys, but grew up in Atlanta. As a teenager David developed skills in bird identification and taxidermy. After serving in the Navy, he graduated from the University of Georgia (B.S., 1949; M.S., 1950), where he studied the relationships between plant succession and bird populations under the renowned ecologist Eugene Odum, and then earned a Ph.D. (1954, under Alden Miller) at the University of California, Berkeley, studying the life cycle of the California Gull.

Over a 40-year period, David taught ornithology and conducted research on birds at Wake Forest University, University of Florida, and University of Virginia's Mountain Lake Biological Station (20 years). In 1979, he moved to the Washington, DC area to become the Ecology Program Director at the National Science Foundation. He later worked at the National Academy of Sciences and served as an editorial consultant to the World Bank, World Wildlife Fund, Wildlife Management Institute, and U.S. Forest Service. David was the editor of several journals, including *The Oriole*, *Bird-Banding*, and *Ornithological Monographs*. He published or edited six books, including "Ecology and Conservation of Neotropical Migrant Landbirds" (coeditor with John M. Hagan III, Smithsonian Institution Press, 1992), "A Guide to Bird Finding in Virginia" (compiler, American Birding Association, 1997), "Mountain Lake Region and its Bird Life: A Century of Bird Studies" (Virginia Museum of Natural History, 2000; reviewed in *Banisteria* 18), and "The History of Ornithology in Virginia" (University of Virginia Press, 2003; reviewed in *Banisteria* 27), and coedited the bird chapter (with

Mitchell A. Byrd) in "Virginia's Endangered Species" (McDonald and Woodward Publishing Company, 1991). In 2009, he self-published "Cedar Key: Birding in Paradise: Finding Birds Then and Now," a guide to the birds (past and present) near his winter residence in Florida. David published about 100 articles in peer-reviewed journals on ornithology, ecology, endangered species, and the history of natural history, including seven papers and two book reviews in *Banisteria*. He was elected to the Washington Biologists' Field Club in 1983. A more detailed summary of David's life and career can be found on the club's website at <http://www.pwrc.usgs.gov/resshow/perry/bios/johnston.david.htm>. He is survived by Esta, his wife of 34 years, 3 children, 9 grandchildren, 8 great-grandchildren, his brother Stephen, and numerous nieces and nephews.

Selected publications of David W. Johnston (DWJ)

1970. High density of birds breeding in a modified deciduous forest. *Wilson Bulletin* 82: 79-82. [Mt. Lake]

DWJ & W. J. Ehmann. 1990. Birds of prey in Virginia: A history of specimen records from 1853 to 1988. *Virginia Avifauna* No. 4, Virginia Society of Ornithology. [addendum published with R. B. Clapp in 1993 as *Virginia Avifauna* No. 5.]

1994. The Golden Eagle in Virginia: Analysis of a century of records. *Raven* 65: 19-37.

1995. Birds and natural history observations in the life of William Byrd II of Westover. *Banisteria* 5: 3-11.

1996. Historical records of the Trumpeter Swan in Virginia. *Banisteria* 7: 8-10.

1997. Some important Virginia specimens in the National Institution for the Promotion of Science. *Banisteria* 10: 9-13.

1998. The two John Claytons of Virginia. *Banisteria* 12: 44-45.

2000. Foods of birds of prey in Virginia. Part I. Stomach analyses. *Banisteria* 15: 3-15.

2004. The Dyke Marsh Preserve ecosystem. *Virginia Journal of Science* 51: 223-272.

2004. The earliest illustrations and descriptions of the Cardinal. *Banisteria* 24: 3-7.

J. V. Calhoun & DWJ. 2010. John Abbot, the English naturalist-artist, in Virginia. *Banisteria* 35: 3-10.

Prepared by Steve Roble, Editor, *Banisteria*



## Reports

### 1. President's Report

It has been a great pleasure to serve as president of the Virginia Natural History Society (VNHS) because it has allowed me to better understand this ongoing effort to discover our regional flora and fauna. It has also allowed me to strengthen my connections with others who share a deep appreciation for this land.

The future of the VNHS looks bright as we continue to have a loyal membership and a quality journal. Since its inception in 1992, 30 of our colleagues have provided governance and many more have written articles that make *Banisteria* such a valuable publication. We have been fortunate to have the continued dedication of our editor, Steve Roble, who has filled that role for the past 16 years, continuing the excellent leadership provided by Richard Hoffman and Joe Mitchell since the first issue of *Banisteria*. Now in its 45<sup>th</sup> issue, the journal continues to exhibit the diversity of coverage appropriate for a journal of natural history. *Banisteria* continues to welcome your manuscripts for future issues. Please encourage others to submit their work as well.

Many thanks go to Tom McAvoy and John White for their efforts in making *Banisteria* accessible to a worldwide audience via the Internet, thus ensuring its value as scientific work becomes ever more distributed by electronic means. It is a great offering to the wider public, made possible by your individual and institutional support of VNHS.

VNHS has growth opportunities ahead as we better market our benefits to a wider audience. I serve on the statewide advisory committee for the Virginia Master Naturalist Program and am an advisor to one of its chapters. These men and women are interested in what we publish and need to be encouraged by you to become members of VNHS. Also tell them about our need for trained and dedicated volunteers for natural history work. There is a great pool of talent that only needs to be asked.

Finally, take a moment to become familiar with fellow members who are serving the VNHS, especially our newest officers and councilors. Joining us as councilors are Paul Marek from the Department of Entomology at Virginia Tech and Chris Milensky, ornithologist and collections specialist at the National Museum of Natural History (NMNH). Alfred Gardner serves as our vice president. He too is at NMNH where he is curator for mammals. Bill Shear ended his 7 year tenure as Secretary-Treasurer at the end of June this year. Rachel Goodman, also in the Department of Biology at Hampden-Sydney College (HSC) has taken

over these extremely important responsibilities. We are all extremely grateful for her and HSC for providing their ongoing administrative support to the VNHS.

Respectfully submitted  
Michael Lachance, President  
Virginia Natural History Society  
1 December 2015

### 2. Secretary-Treasurer's Report

As of November 9, 2015, the society has 95 members, including 14 institutions. This represents a slight decline in membership, with 105-127 members recorded in December of the last five years. The recent maximum of membership was in 2004, when the society had 165 members, including 22 institutions.

Our current bank balance is \$ 12,686.68, up from \$9,611.54 in December 2014.

The results of the 2015 election were as follows:

Vice President:  
Alfred L. Gardner

Councilors:  
Paul Marek (3-year term)  
Christopher M. Milensky (4-year term)

Respectfully submitted,  
Rachel M. Goodman  
Secretary/Treasurer

### 3. Webmaster's Report

Additional pdf reprints of papers from past issues of *Banisteria* were made available on the society's website during the past year. The three most frequently accessed papers during October 2015 were:

1. Common and Occasional Bryophytes of the Virginia Piedmont (*Banisteria* 21)
2. Potomac Gorge BioBlitz (*Banisteria* 32)
3. The Dytiscidae, Gyrinidae, Haliplidae, Hydrochidae, Aquatic Hydrophilidae, and Noteridae (Insecta: Coleoptera) of the North Tract of the Patuxent Research Refuge, Maryland (*Banisteria* 33)

VNHS website traffic during the past year is summarized in the following table:

Month	Visits	Pages	Files	Hits
Oct 2015	1257	2596	10720	15558
Sep 2015	1236	2877	8683	13519
Aug 2015	1239	2139	12003	16101
Jul 2015	1137	1913	12189	16028
Jun 2015	1270	2211	11916	16060
May 2015	1299	2385	10000	15590
Apr 2015	1256	2551	10804	18176
Mar 2015	1466	2421	10326	15244
Feb 2015	1341	3388	9522	15343
Jan 2015	1616	3604	9470	15353
Dec 2014	1342	2260	8494	14350

Respectfully submitted,  
John White, Webmaster

#### 4. Editor's Report

This is the only issue of *Banisteria* that will be published in 2015, the first year since 1993 that the society has not produced two issues per year. This is entirely due to the unusually low number of suitable submissions during the past year. I am currently working on the first issue of *Banisteria* for 2016. More submissions are needed for both 2016 issues of the journal, so please consider submitting a paper, note, biography, historical contribution or book review concerning the natural history of Virginia. I hope to have the next issue ready for printing by late spring.

I would like to thank the following people for reviewing manuscripts submitted to *Banisteria* during the past two years (\* = reviewed more than one paper): Bob Androw, Bill Baltosser, Jeff Beane, Paul Bedell, Art Bogan, Yves Bousquet, Dana Bradshaw, Ron Caldwell, Dave Culver, Bob Davidson, Torsten Dikow, Matt Dittler, Mike Donahue\*, Lance Durden, Sandra Erdle, Dave Etnier, Ryan Evans, Mike Fies, Ollie Flint, Todd Fredericksen, Gary Graves, Curt Harden, Tom Henry, Bob Hershler, John Holsinger, Bob Jenkins, Joe Mitchell\*, Nancy Moncrief, Chuck Parker, Tom Pauley, Bob Rose, Rod Simmons, Dick Smith, Charlie Staines\*, Lionel Stange, Wayne Starnes, Warren Steiner, Dirk Stevenson, Catherine Tauber, Johnny Townsend, John Walker, Al Wheeler, John Whitaker, Tom Wieboldt\*, and Bill Williams. Their efforts were important in maintaining the quality of *Banisteria*.

Respectfully submitted,  
Steve Roble  
Editor, *Banisteria*

#### Announcements

##### 1. Newsletter Editor

Dr. Paul Marek, one of the society's newly elected councilors, has volunteered to serve as the next newsletter editor. The newsletter is intended to appear twice per year between issues of *Banisteria* and is distributed electronically via email. If you have an idea for an article or an announcement of general interest to the membership please contact Paul at pmarek@vt.edu. Remember to provide your email address when renewing your membership for 2016 if you wish to receive future issues of the newsletter.

##### 2. News of Members

Dr. William A. (Bill) Shear, Trinkle Distinguished Professor of Biology at Hampden-Sydney College, retired in June 2015 after 41 years at that institution. At the College's Final Convocation ceremony in April, he received the John Peter Mettauer Award for Research Excellence for the fourth time, and at the Commencement Ceremony received the Senior Class Award. Bill has authored more than 200 papers and book chapters on a variety of topics, including chemical ecology, milliped and arachnid taxonomy, paleontology, and evolution, and ranks as the most prolific researcher in the 240-year history of the College. He also edited the book "Spiders: Webs, Behavior, and Evolution" (Stanford University Press, 1986) and was coeditor of a special issue (2007) of the journal *Zootaxa* entitled "Linnaeus Tercentenary: Progress in Invertebrate Taxonomy." Bill has been a Senior Scientific Associate of the Virginia Museum of Natural History since 1996 and has served as the Myriapoda (millipeds and related groups) section editor for *Zootaxa* for many years. His long-term passion for growing irises led him to write a book on the subject entitled "The Gardener's Iris Book" (2002, Taunton Press).

Bill served as Secretary-Treasurer of the Virginia Natural History Society from January 2008 to June 2015. We congratulate Bill on his retirement, thank him for his service to the society, and wish him well in his future endeavors. Rachel M. Goodman, Associate Professor of Biology at Hampden-Sydney College, has graciously agreed to be the society's new Secretary-Treasurer.

Charles E. "Mo" Stevens, Jr., of Charlottesville, a longtime member of the Virginia Natural History Society (joined in 1993), passed away in October at the



age of 89. An avid naturalist, he was a lifelong resident of Albemarle County with special interests in birds, plants, and geology. He coauthored several editions of the "Atlas of the Virginia Flora" with Alton M. Harvill, Jr. (see *Banisteria* 38) and various other colleagues between 1977 and 1992 and published numerous papers and notes in *The Raven*, the journal of the Virginia Society of Ornithology. A more detailed obituary may appear in a future issue of *Banisteria*.

### 3. Archives of *Virginia Birds* available on-line

*Virginia Birds*, a quarterly journal published since 2004 by the Virginia Society of Ornithology, summarizes rare and interesting seasonal bird sightings. On-line copies of past issues are now available at the following website: <http://www.virginiabirds.net/virginia-birds-archive.html>

### 4. Recent publications of relevance to regional natural history

Evans, A. V. 2014. *Beetles of Eastern North America*. Princeton University Press, Princeton, NJ. 560 pp. <http://press.princeton.edu/titles/10218.html> (\$35 paper)

Jeffries, S., & T. Wentworth. 2014. *Exploring Southern Appalachian Forests: An Ecological Guide to 30 Great Hikes in the Carolinas, Georgia, Tennessee, and Virginia*. University of North Carolina Press, Chapel Hill, NC. 336 pp. [http://uncpress.unc.edu/browse/book\\_detail?title\\_id=3545](http://uncpress.unc.edu/browse/book_detail?title_id=3545) (\$45 cloth, \$22 paper)

Spira, T. P. 2015. *Waterfalls and Wildflowers in the*

*Southern Appalachians: Thirty Great Hikes*. University of North Carolina Press, Chapel Hill, NC. 304 pp. [http://uncpress.unc.edu/browse/book\\_detail?title\\_id=3615](http://uncpress.unc.edu/browse/book_detail?title_id=3615) (\$24 paper)

Spira, T. P. 2011. *Wildflowers and Plant Communities of the Southern Appalachian Mountains and Piedmont: A Naturalist's Guide to the Carolinas, Virginia, Tennessee, and Georgia*. University of North Carolina Press, Chapel Hill, NC. 540 pp. [http://uncpress.unc.edu/browse/book\\_detail?title\\_id=1872](http://uncpress.unc.edu/browse/book_detail?title_id=1872) (\$26 paper)

Kleopfer, J. D., T. S. B. Akre, S. H. Watson, & R. Boettcher. 2014. *A Guide to the Turtles of Virginia*. Bureau of Wildlife Resources Special Publication Number 4, Virginia Department of Game and Inland Fisheries, Richmond, VA. 44 pp. <https://www.shopdgif.com/home.cfm> (\$7.95 paper)

Reynolds, R. J., & R. T. Fernald. 2015. *A Guide to the Bats of Virginia*. Bureau of Wildlife Resources Special Publication Number 5, Virginia Department of Game and Inland Fisheries, Richmond, VA. 40 pp. <https://www.shopdgif.com/home.cfm> (\$6.95 paper)

Paiero, S. M., M. D. Jackson, A. Jewiss-Gaines, T. Kimoto, B. D. Gill, & S. A. Marshall. 2012. *Field Guide to the Jewel Beetles (Coleoptera: Buprestidae) of Northeastern North America*. 1st Edition. Canadian Food Inspection Agency. 411 pp.

Note: The hard copy edition of this field guide to 164 species is already out of print, but a free downloadable version has been made available at this website: [http://www.biodiversityinfocus.com/pdfs/Jewel\\_Beetle\\_Field\\_Guide\\_English.pdf](http://www.biodiversityinfocus.com/pdfs/Jewel_Beetle_Field_Guide_English.pdf)

## Student Membership Incentive

Recognizing that students interested in natural history represent the main pool of prospective future members of the Virginia Natural History Society, the Executive Committee of the Society is soliciting nominations from our members for a **free one-year membership in the Society** to selected college, university, and high school students. We believe that receiving this membership will make more students aware of the Society and appreciate the benefits of continued membership. The Society will fund up to twenty students in 2016. Nominees should be undergraduate or graduate students at a college or university in Virginia, or outstanding high school students, who are particularly interested in natural history. Nominators should be members of the Society and provide the following information for up to three students: Name, institution, mailing address, e-mail address, and a short paragraph describing the students' interests in and activities related to Virginia natural history. Nominations should be sent to the Secretary-Treasurer, Rachel Goodman at [rgoodman@hsc.edu](mailto:rgoodman@hsc.edu).

## Virginia Natural History Society

<http://virginianaturalhistorysociety.com/>

### General Information

The Virginia Natural History Society (VNHS) was formed in 1992 to bring together persons interested in the natural history of the Commonwealth of Virginia. The VNHS defines natural history in a broad sense, from the study of plants, animals, and other organisms to the geology and ecology of the state, to the natural history of the native people who inhabit it. The goals of the VNHS are to promote research on the natural history of Virginia, educate the citizens of the Commonwealth on natural history topics, and to encourage the conservation of natural resources.

Dissemination of natural history information occurs through publication of the journal *Banisteria*, named for John Banister (1650-1692) who was the first university-trained naturalist to work in Virginia. The first issue was published in 1992, and the journal is published twice per year in spring and fall. Articles cover a wide array of subjects, and prospective authors are encouraged to submit manuscripts on any aspect of natural history in Virginia; papers may pertain to Virginia or regional archaeology, anthropology, botany, ecology, zoology, paleontology, geology, geography, or climatology. Book reviews, biographies, obituaries, and historical accounts of relevance to natural history in Virginia also are welcomed. Manuscripts are peer-reviewed for suitability and edited for inclusion in the journal.

Page charges (\$20/page) are waived if the sole or first author is a VNHS member. All authors must pay \$75/page if they desire color printing of figures. The society's website contains detailed instructions for authors and the titles, abstracts or full PDF versions of articles from past *Banisteria* issues.

### Memberships

The VNHS is open to anyone with an interest in natural history and welcomes participation by all members in society activities and efforts to promote education and conservation. Membership includes a subscription to *Banisteria* and invitations to periodic symposia and field events. Annual dues for members are \$20 (per calendar year); library subscriptions are \$40 per year. Checks should be sent to the Secretary/Treasurer, who also has most back issues of *Banisteria* available for sale. The VNHS is a tax-exempt, nonprofit, society under Section 501(C)3 of the IRS. We welcome donations to support our mission in Virginia.

## Virginia Natural History Society

### Application for Membership

Name \_\_\_\_\_

Address \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Zip Code \_\_\_\_\_

Phone \_\_\_\_\_

Email \_\_\_\_\_

Area(s) of Interest \_\_\_\_\_

### ANNUAL DUES AND SUBSCRIPTIONS TO *BANISTERIA*

(memberships and subscriptions are by calendar year; subscribers/members outside the United States should add \$3.00 for additional postage)

- ☐ \$500.00 Life (not annual)
- ☐ \$300.00 Benefactor
- ☐ \$100.00 Patron
- ☐ \$50.00 Supporting
- ☐ \$40.00 Institutional
- ☐ \$25.00 Family
- ☐ \$20.00 Regular
- ☐ \$5.00 Student (see below)
- ☐ I have added a contribution of \$\_\_\_\_\_ to my membership dues.

The special student rate is applicable only when accompanied by the following certification signed by a faculty advisor (students are also eligible for a 1-year free membership if an advisor's nomination is approved by the society's Executive Committee; see nomination guidelines in *Banisteria*).

Institution \_\_\_\_\_

Advisor \_\_\_\_\_

Date \_\_\_\_\_

**Make checks or money orders payable to:**  
Virginia Natural History Society

**Send membership form and dues to:**  
Dr. Rachel Goodman, Secretary-Treasurer  
Virginia Natural History Society  
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